IMPERIAL AGRICULTURAL
RESEARCH INSTITUTE, NEW DELHI.

TRANSACTIONS
OF THE
AMERICAN
ENTOMOLOGICAL SOCIETY

VOLUME LIX

16270

HALL OF THE ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA
LOGAN SQUARE
1933

LANCASTER PRESS, INC., LANCASTER, PA.

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TRANSACTIONS

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SOME DERMAPTERA FROM ANGOLA, NORTHERN RHODESIA AND THE BELGIAN CONGO, WITH THE DESCRIPTION OF A NEW SPECIES OF KARSCHIELLA

BY JAMES A. G. REHN

(Text figure)

A number of years ago the Academy of Natural Sciences of Philadelphia purchased a small collection of insects from N'Dalla Tando, northern Angola, which included a few species of earwigs. Dr. Malcolm Burr, for many years our leading authority on these insects, visited Angola, Northern Rhodesia and the Katanga district of the Belgian Congo during the year 1927, and while engaged in other activities collected a series of earwigs, which on his return to England he was generous enough to send to me for study. Various duties prevented me from completing this work until the past few months. The results here presented are limited but of particular interest, as they bear upon the fauna of a' portion of Africa regarding which our information is very meager. Unfortunately certain specimens which indicate the presence of additional new species are not in sufficiently complete condition for description, and must await the examination of more nearly perfect material.

Dr. Burr sent to England a most interesting set of letters detailing his African experiences and these have been published in the Entomologists' Record.[1] A number of comments upon the Dermaptera here studied appeared in these absorbing travel accounts, which also contain much information upon the habits of the Orthoptera collected.

A first set of the material here studied has been placed in the Academy series, and a duplicate representation of Dr. Burr's collection will be forwarded to the Museum of Oxford University.

PYGIDICRANIDAE

KARSCHIELLINAE

Karschiella neavei Burr

1909. *Karschiella neavei* Burr, in Neave, Ann. Soc. Entom. Belg., LII, p. 96. [♂, ♀; Province of Katanga, Belgian Congo.]

NORTHERN RHODESIA: Tshinsenda, elevation about 4300 feet; August 9, 1928; (Silvester Evans; in grass hut); one male with abdomen crushed but fragments in position.

This individual answers the very brief and inadequate description of the species and differs from *büttneri* (Karsch)[2] and *camerunensis* Verhoeff,[3] the other known species of similar proportions, in a number of structural details, such as the exact shape of the pronotum, of the coalesced tegmina and the form and sculpture of the anal segment of the male. On account of the crushed condition of the anal segment it is inadvisable to attempt its reconstruction and description, but it may be noted that no caudad projecting processes are indicated, although longitudinal dorso-lateral carinae are well marked. Zacher's *bidentata*,[4] described without indication of size from a single Cameroons male, is seen by the original figure to possess projecting processes on this segment, and so, if my interpretation of *neavei* is correct, *bidentata* cannot be a synonym of *neavei*, as has been suggested by Burr.[5]

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[1] These letters as published embrace eighteen installments, which appeared in the following numbers of the journal: 1927, nos. 10–12; 1928, nos. 1, 2, 4, 7, 8, 9, 10 and 12; 1929, nos. 1, 4, 7, 8 and 10; 1930, nos. 1, 2, 5 and 6.

[2] Berlin. Ent. Zeitschr., XXX, p. 86, pl. 3, fig. 4, (1886). [♂; Kuako to Kimpoko, West Africa.]

[3] Zoolog. Anz., XXV, p. 184, (1902). [♂; Cameroons.]

[4] Zoolog. Jahrb., Abt. Syst., XXX, heft 4, p. 350, fig. 2, (1911). [♂; Cameroons.]

[5] Ann. Mag. Nat. Hist., (8) XIII, p. 378, (1914).

In addition to the broad type locality and the record here given, *neavei* has been recorded from Kabelwe, Katanga, Belgian Congo, by Menozzi.[6]

Karschiella pygmaea new species

This species is a small replica of *K. büttneri* Karsch[7] from the lower Congo, agreeing with the description of that species in virtually all structural features except the very weakly, instead of deeply, indicated medio-longitudinal sulcation of the pronotum. The size, however, is little more than half that of *büttneri*. From *camerunensis* Verhoeff, *bidentata* Zacher and *neavei* Burr this species is as distinct as *büttneri*, showing marked differences in the pronotal form, that of the tegmina and sternal lobes or in the disposition, development and production of the longitudinal dorso-lateral carinae of the anal segment of the male.

Type.—♂; N'Dalla Tando, Angola. December 29, 1908. [Academy of Natural Sciences of Philadelphia, Type no. 5522.]

Size small (length of body, 14.2–15 mm.); form as in *K. büttneri;* surface of most of head, pronotum, tegmina, sterna, pleura and greater portion of abdomen closely shagreenous and dull, this becoming weaker and impresso-punctate and somewhat more shining distad on abdomen, the latter clothed with many short, adpressed hairs.

Head faintly broader than greatest length (as 38 to 35), cordiform in outline, greatest width appreciably greater than pronotal width (as 38 to 34); occiput with low carinulate sublongitudinal ridges eight in number, the two mesal pairs converging caudad, the other pairs subparallel: antennae composed of twenty-two articles; proximal large, equal in length to second, third and fourth combined, glabrous; second very brief; third three-fifths as long as first, infundibuliform; fourth brief, transverse moniliform, thence distad the articles regularly increase in length to the fifteenth, from which they are subequal in length to the apex; from the eighth distad the articles regularly narrow distad, the distal not more than half the width of the equally long fifteenth; proximal antennal article shining, as is the clypeus, labrum and mandibles.

Pronotum rectangulate, transverse, greatest length contained faintly more than one and one-third times in greatest width of same: cephalic margin moderately produced mesad, there transversely truncate; latero-cephalic angles narrowly rounded rectangulate, each with several short, stout bristles; lateral margins faintly converging caudad, straight-arcuate; caudo-lateral angles broadly arcuate to the caudal margin which mesad is faintly angulato-concave: surface of pronotum with the very characteristic transverse broadly U-shaped sulcation of the genus deeply indicated, laterad continuing straight cephalad to the neighborhood of the cephalic margin of the pronotum; medio-longitudinal sulcation of prozonal section of the pronotum faintly and shallowly indicated, on the metazona represented cephalad by a faint sulcus and caudad by a very low and fine carinulation.

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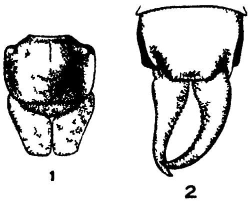
[6] Rev. Zool. Bot. Afric., xvi, p. 30, (1928).

[7] Berlin. Ent. Zeitschr., xxx, p. 86, pl. 3, fig. 4, (1886).

Tegmina in greatest length along humeral ridge (diagonal) subequal to medio-longitudinal length of pronotum, as seen from dorsum the two tegmina have the humeral ridges (in that view forming the apparent lateral borders) regularly and straight convergent distad of a brief proximal arcuation; distal margins of tegmina collectively transversely arcuato-truncate, each margin subequal to two-thirds the width of the deplanate dorsum of each tegmen; humeral ridges marked, elevated, their surface sharply imbricato-denticulate; lateral face of tegmina relatively broad, widest faintly proximad of middle, its greatest width equal to one-fourth the length of the lateral face, costal margin not evenly arcuate, obliquely subtruncate proximad and distad of widest point; humeral ridge moderately overhanging laterad and lateral face in consequence concave in section.



Karschiella pygmaea new species. Male (type) N'Dalla Tando, Angola (× 4) Fig. 1—Dorsal view of pronotum and tegmina. Fig. 2—Dorsal view of anal segment and forceps.

Sternal lobes similar to those of *K. camerunensis* figured by Burr[8] except that the caudo-lateral expansions of the prosternum are proportionately less strongly transverse.

Abdomen faintly depressed, in dorsal view evenly widening to eighth tergite, thence distad faintly narrowing: tenth tergite (anal segment) transverse rectangulate, lateral margins nearly straight in dorsal aspect, surface laterad in line with external base of the forceps with the usual carinate lamellations of the genus markedly developed as heavy fold-like ridges, slightly converging caudad, obsolete cephalad and progressively strengthening caudad, terminating as acute lanceolate projections free from and dorsad of the caudal margin of the tergite, caudad of which they extend but briefly; caudal margin between productions obliquely truncate laterad and transverse truncate mesad; surface of tergite between ridges deplanate, distad rather sharply rounding down to the lip-like distal margin, mesad this area bears intermarginally to the transverse truncate section a transverse arcuate impression. Ultimate sternite (subgenital plate) in ventral aspect subquadrate, slightly transverse, lateral sections reflexed and vertical, so that the apparent lateral borders in ventral aspect are parallel folds of the sternite; distal margin very broadly low arcuate, somewhat flattened mesad, distal third of sternite weakly rising to forcep-bases, this section also shallowly impressed medio-longitudinally; sharply reflexed lateral portions of ultimate sternite broad proximad, regularly narrowing distad.

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[8] Gen. Insect., Dermaptera, pl 1, fig. 8c, (1911).

Forceps robust, asymmetrical, of the type usual in *Karschiella* and *Bormansia*, the dextral arm more strongly and regularly arcuate than the sinistral, the latter subsigmoid in its curvature, general trend slightly sinistrad, both with the apex briefly but distinctly hooked, in section subdeplanate; internal margins regularly crenato-dentate except at the immediate apices; in profile both arms are moderately upcurved in distal three-fifths.

Limbs with the femora distinctly multicarinate as in other species of the genus, the carinae emphasized by their linear series of subimbricate shagreen; cephalic femora proportionately more robust and inflated than the more elongate and more slender median and caudal ones; median limbs slightly, caudal limbs distinctly more compressed than the cephalic pair.

General color dull mummy brown, occasionally (type) paling slightly on pronotum and tegmina to bister, the head becoming russet on the lower face; clypeus, labrum and mandibles virtually tawny; palpi and limbs basically ochraceous-buff. Eyes dull fuscous; antennae with proximal article of the head color, then rather abruptly passing to dull prout's brown. Median and caudal femora mesad very broadly and in large part annulate with prout's brown, the margins of the same cloud-like marking not sharply indicated.

Length of body exclusive of forceps, 14.2[9] mm.; length of pronotum, 2.18; greatest width of pronotum, 2.85; diagonal greatest length of tegmen along humeral ridge, 2.1; greatest width of dorsal surface of tegmen, 1.34; length of tenth tergite, 2.1; greatest width of same, 3.36; length of dextral arm of forceps, 3.78.

In addition to the type I have before me a paratypic female bearing the same locality datum as the type but taken December 29, 1908. It shows no noteworthy differences from the above description.

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[9] The abdomen is retracted by abnormal telescoping.

Bormansia species

ANGOLA: N'Dalla Tando; December 29, 1908; one individual lacking apex of abdomen; [A.N.S.P.].

This species is no larger than *B. meridionalis* Burr[10] and distinctly smaller than *B. africana* or *impressicollis* Verhoeff,[11] but it differs from both of these, as well as from *orientalis* Borelli,[12] in the shape of the metanotum. Its recognition must await the acquisition of perfect material.

Bormansia species

ANGOLA: Chimdumba, Lumeji River; July 6, 1927; (M. Burr); one male (lacking forceps).

Unfortunately this interesting specimen lacks the forceps which, as Dr. Burr tells us,[13] were broken off by the native boy who found it in fuel for the camp fire. The anal segment, however, is entire and with its characteristic sculpture intact. The species is a large one, as great in body bulk as *B. africana* and *impressicollis* Verhoeff, and very different in structure from the male sex of the former, as well as from *orientalis* Borelli and *meridionalis* Burr. This species also must await the acquisition of perfect material before definite determination is possible.

APACHYIDAE

Apachyus depressus (Palisot de Beauvois)

1805. *Forficula depressus* Palisot de Beauvois, Ins. Rec. Afriq. et Amér., p. 36, Orth. pl. 1, fig. 5. [♂; Oware (present Southern Nigeria, west of mouth of Niger River), West Africa.]

ANGOLA: Munhango; July 1927; (M. Burr); one female in instar preceding maturity. Lungue Bungu River; October 2–4 and 9, 1927; (M. Burr); one male, one female (teneral), two immature females in instar preceding maturity. Upper Luena River, Moxico District; May 15, 1927; (M. Burr); one immature male and one immature female in the instar preceding maturity.

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[10] In Distant, Insecta Transvaal., I, p. 97, fig. 13, (1904). [♂; Zoutpansberg, Transvaal]

[11] Zoolog. Anz., XXV, p. 184, (1902). [*Africana:* ♂, ♀; German East Africa (= Tanganyika Territory). *Impressicollis:* ♀; Taita District, German East Africa (= Tanganyika Terr.).] In re these species see also Borelli, in Voy. Alluaud et Jeannel en Afrique Orient. (1911–1912), Résultats Scient., Ins. Orth., I, Derm., p. 5, pl. 1, (1915).

[12] Bull. Mus. Hist. Nat. Paris, XVIII, p. 221. [♂ and juv.: Vicinity of Sungoué, Prov. of Gorongoza, Mozambique.]

[13] Entom. Record, XL, p. 145, (1928).

This species, as I have already pointed out,[14] has a much more extensive distribution than its cogener *A. murrayi*, which is found associated with *depressus* in the territory inhabited by the two of them. The species are quite distinct, and can be distinguished even in the immature condition.

The above are the first Angola records aside from one from Benguella. In addition to previously reported material I have before me two males from Fort Crampel, Ubangi-Chari, in the Hebard Collection. This record extends the range of the species northward across the Ubangi-Shari divide, thus broadening in that territory the distributional area of the species shown in my map of the same published in 1924.[15]

Apachyus murrayi Dohrn

1863. *A[pachyus] murrayi* Dohrn, Stettin. Entom. Zeitung, XXIV, p. 44. [Sex ?; Old Calabar, West Africa]

ANGOLA: Lungue Bungu; October 9, 1927; (M. Burr); one female.

This specimen fully agrees with the female of *murrayi* from Bitje, Ja River, Cameroons, previously reported by me.[16] The size, except for a more marked retraction of the abdomen, is similar, and the coloration is identical except that the infuscate portion of the antennae, i.e. distad of the third article, is paler—more nearly dresden brown.

The present record extends the range of *A. murrayi* distinctly to the southward of the West African Forest Province, to which I had considered it to be limited.[17]

LABIIDAE

LABIINAE

Labia ochropus (Stål)

1855. *F[orficula] ochropus* Stål, Öfv. Kongl. Vetensk.-Akad Förhandl., XII, p. 348. [♂, ♀; Port Natal (Durban), Natal.]

NORTHERN RHODESIA: Lunsenfwa River, Luano Valley; July 5, 1928; (M. Burr: under bark); one adult male, one male in the instar preceding maturity.

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[14] Bull. Am. Mus. Nat. Hist., XLIX, pp. 376–379, (1924).

[15] Bull. Am. Mus. Nat. Hist., XLIX, p. 378, fig. 26, (1924).

[16] Bull. Am. Mus. Nat. Hist., XLIX, p. 379, (1924).

[17] Bull. Am. Mus. Nat. Hist., XLIX, p. 378, fig. 26 and p. 380, (1924).

This species has appeared frequently in the literature as *Labia marginalis* (Thunberg), but I have elsewhere[18] expressed my reasons for preferring the much more clearly applicable *ochropus*. The adult has the limbs clear yellow, without any proximal dark clouding on the femora, while antennal articles one and two and nine distad are infuscate. The immature male has the proximal half of all the femora and of all the tibiae sharply and solidly infuscate, the pale distal half of the femora also bearing on each face a slight but evident dark cloud. One antenna of the immature male has the ninth article pale, in the other it is infuscate.

The distribution of this species has already been summarized and mapped by me.[19]

FORFICULIDAE

FORFICULINAE

Forficula senegalensis Serville[20]

1839. *Forficula senegalensis* Serville, Hist Nat. Ins, Orth, p 39. [♂, ♀; Senegal.]

ANGOLA: Villa Luzo; May 3 and 31, 1927; (M. Burr); one male, one female.

NORTHERN RHODESIA: Chisorwe, Luano Valley; February 16 to July 7, 1928; (M Burr); three males, three females

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[18] Bull. Am. Mus Nat. Hist., XLIX, pp 381–382, (1924).

[19] Bull. Am. Mus. Nat. Hist, XLIX, p. 381, fig 27, (1924).

[20] There is no question in my mind of the synonymy of Menozzi's recently described *Forficula bequaerti* (Rev. Zool Bot. Afr., XIX, p 96, figs. 1 and 2, (1930): [♂, ♀; Mt. Ninagongo, 3300 meters, and Burunga, 1800 meters, Belgian Congo]) with Burr's *Forficula sjostedti*. I have before me paratypic males and females of the latter from Kiboscho, Kilimanjaro, 3000–4000 meters elevation, and also males and females recorded by me as *F. sjostedti* (Arkiv for Zoologi, 17A, no. 15, p. 3, (1925)) from Mt. Karissimba and Sabinjo, other peaks of the Birunga Volcanoes, the territory from which *bequaerti* was described, and from which *sjostedti* was also recorded by Burr in 1912 (Sitzsb Gesell. Naturforsch. Freunde, Berlin, 1912, p. 327: [Mts. Karissimbi and Niragongo, (prob. in err for Ninagongo), Birunga Volcanoes]). The study of this material, which was critically examined by me in the above mentioned 1925 paper, and Menozzi's description brings to light nothing valid on which to base the species *bequaerti*, which was originally compared briefly with *F. senegalensis* and not directly with *sjöstedti*. The male internal genitalia of *bequaerti* were said to differ from those of *sjöstedti* in the sole mention of the latter species, but a comparison of the figure of the same in *bequaerti* (fig 2 on page 97) shows little if any difference from that of the same parts in *sjostedti* given by Burr (Journ. Royal Micros. Soc., 1916, p. 12, pl. 3, fig. 10, (1916)), if reasonable allowance is made for the extension or retraction of parts.

The latter small series demonstrates the marked variation in size to be found in this species at a single locality. The extremes of the three Chisorwe males measure as follows: length of body (exclusive of forceps), 11.8 mm., 13.2; length of forceps, 3.9, 5.9. None of the males in the present representation is macrolabic, although the small Chisorwe male is virtually cyclolabic, and in addition has the apices of the folded wings but narrowly evident distad of the distal margin of the tegmina.

I have already discussed the probable synonymy of *Forficula rodziankoi* Semenov under *senegalensis*,[21] and still lacking nonalate material from Abyssinia I am not in a position to add further evidence to my earlier remarks. However, a review of the situation, as then stated and from the same material, confirms and strengthens my expressed opinion as to the synonymy of *rodzianko*i.

The known area of distribution of *senegalensis* was mapped by me in 1924.[22] A note with the present material states that it was taken in the Luano Valley on reeds and at light.

DIAPERASTICINAE

Diaperasticus erythrocephalus (Olivier)

1791 *Forficula erythrocephala* Olivier, Encycl. Meth , Ins., vi, p. 468. [♀ ; Cape of Good Hope]

ANGOLA. Villa Luzo; May 7, 1927, (M Burr); three males. Cohemba;[23] August 30, 1927; (M. Burr); one female

BELGIAN CONGO· Lubudi River, Katanga; (M. Burr); one female.

NORTHERN RHODESIA. Chisorwe, Luano Valley; February 16 to July 7, 1928; (M Burr); thirty-two males, thirty-eight females.

I have already discussed the rather lengthy synonymy and marked variability of this widely distributed African species.[24] Of the present series a single male from Villa Luzo, the female from Lubudi River, and two females from Chisorwe are of the type with abbreviate wings not evident distad of the tegmina. The others are all supplied with fully developed alar appendages.

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[21] Arkiv for Zoologi, 17A, no. 15, p. 2, (1925).

[22] Bull. Amer. Mus. Nat. Hist., XLIX, p. 389, fig. 32.

[23] In his narrative Burr calls this "a place . . . at kilo 782 along the line of the Benguela Railway, at an altitude of about 2500 ft "

[24] Bull. Am. Mus. Nat. Hist., XLIX, pp. 398-401, fig. 40, (1924).

In size the Chisorwe and Villa Luzo series average larger than the Faradje and Stanleyville representations previously studied,[25] being nearly or quite equal in bulk to specimens already reported from Natal.[26] The extremes of each sex from Chisorwe measure (in millimeters) as follows:

	Length of body (exclus. of forceps)	Length of tegmen	Length of forceps
♂	8.2	2.01	2.52
♂	11.7	2.77	4.36
♀	9	2.52	2.91
♀	11.6	2.77	2.91

The forceps of the males exhibit some variation in the degree to which the distal portion is moderately arcuate or suboblique convergent with apices briefly uncinate. This is, of course, noted in any extensive series of the species.

The distribution of this broadly distributed species has been summarized and mapped in my above mentioned paper.

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[25] Bull. Am. Mus. Nat. Hist., XLIX, pp. 398–401, (1924).

[26] Ann. Transv. Mus., IX, p. 6, (1922).

A NEW HESPERID FROM MEXICO

(LEPIDOPTERA: HESPERIIDAE)

BY R. C. WILLIAMS, JR.

(Plate I)

Nascus mackeyi new species

Male. Dark brown, the base of the upper wings and the disc and the lower portion of the lower wings rufous. This portion is cut on the lower wing with two bands of the ground color, the inner band short, covering two interspaces only, the outer one running down to a point opposite the anal angle. The upper wing with hyaline spots, a curved row of four apical ones, the lower one twice as long as the others, followed by one (right) and two (left) minute dots. Four large discal spots, one in the cell, one beyond the cell and below, a third, smaller, beyond this, and a fourth between the first and second, removed towards the outer margin. Below the wings are of the same basal color with the base of both wings and the inner margin of the lower of a bright yellow color, with a dark spot opposite the inner band of the upper side. The hyaline spots of the upper side are repeated. The costal fold is wide. The fringes are concolorous except for the upper portion of the outer margin of the secondaries where they are whitish. Body rufous above, yellowish below, palpi yellowish white. Expanse 53 mm.

Female. Brown, the lower wings basally lighter in color, cut with two bands of the ground color. Upper wings with four curved apical spots, the fourth twice as long as the others, followed by two distinct small white spots. Five large discal spots, four in a band across the disc, one on the outer margin, one in the cell, another, the largest, beyond, and a fourth, smaller, beyond this. The fifth, rectangular, lies between the third discal spot and the apical spots. The wings below are of the same ground color, the base of the upper wing and the basal half of the lower wing yellow. The hyaline spots of the upper wing are repeated. The fringe of the upper wing is concolorous. The lower wing is rather denticulate externally, the fringes whitish, cut at the veins. Body above brown, below yellowish, palpi yellowish white. Expanse 56 mm.

Type, ♂ and *allotype,* ♀.—San Christobal, Chiapas, Mexico. (J. J. White.)

Paratypes.—2 ♀; San Pedro Sula, Honduras. 1 ♀; Eden, Nicaragua, September 13. 1 ♀; Neiva, Colombia. 3 ♀; Villa Rica, Paraguay, June 13, (Jorgensen). 1 ♀; Sapucay, Paraguay, December 24, (Heinrich).

The paratypes have been in the collection of the Academy of Natural Sciences of Philadelphia for a long time associated with the males of *phocus* Cramer.

Mackeyi male differs from *phocus* in its darker color and the rufous instead of olivaceous basal color above. The spots of *phocus* are yellow hyaline and are outlined with a dark edge, while in *mackeyi* they are white hyaline and not outlined. The discal spots of *phocus* are close together in a triangular group, while in *mackeyi* one is removed towards the outer margin.

The female of *phocus* was described and figured by Hewitson as *pherenice.* Godman and Salvin in the Biologia associated them together, I believe correctly. The figure agrees with a female in our collection undoubtedly belonging to *phocus.*

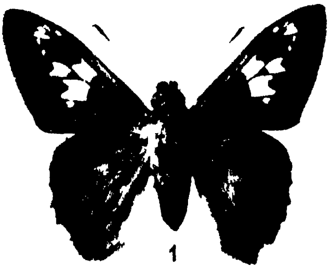
The females of *mackeyi* are very much like those of *phocus* but differ in that the olivaceous yellow color of *phocus* on the lower wing below is cut by two darker bands, while in *mackeyi* it is only cut into slightly at the costal margin, and there is no second band, its position only indicated by a small spot of yellow beyond the basal portion.

While it seems curious that this conspicuous species has escaped attention until now, it is likely that the females are associated in collections with *phocus*, as was the case in our own collection.

Named for Miss Laura S. Mackey, assistant in the Entomological Department of the Academy, in recognition of her valuable work on our insects. The types and paratypes are deposited in the Academy's collection in Philadelphia.

EXPLANATION OF PLATE I

Figures 1 and 2. Upper and lower of *Nascus phocus* Cramer, male.
" 3 and 4. Upper and lower of *Nascus phocus* Cramer, female.
" 5 and 6. Upper and lower of *Nascus mackeyi* new species, male.
" 7 and 8. Upper and lower of *Nascus mackeyi* new species, female.



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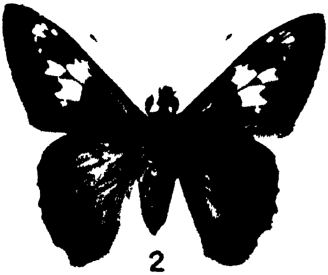

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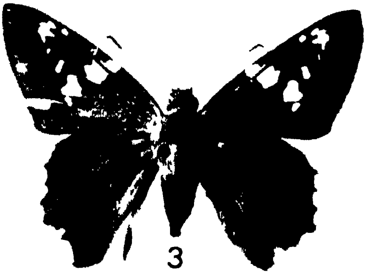

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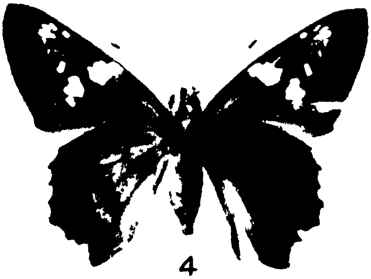

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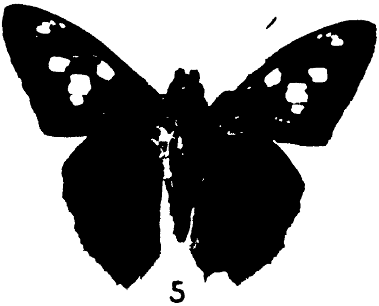

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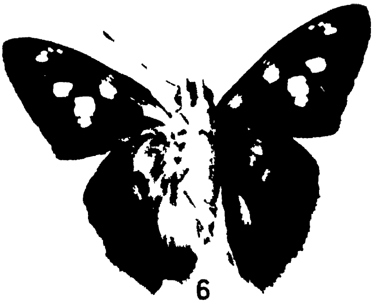

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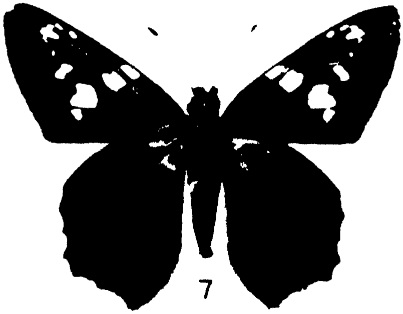

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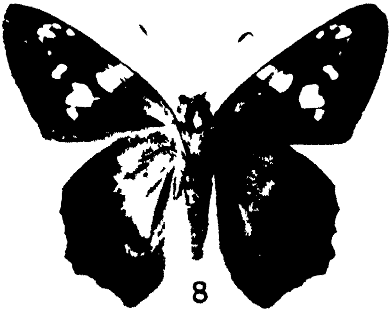

8

WILLIAMS MEXICAN HESPERIIDAE

STUDIES IN THE DERMAPTERA AND ORTHOPTERA OF COLOMBIA

SUPPLEMENT TO PAPERS ONE TO FIVE

Material Received since Previous Publications

BY MORGAN HEBARD

(Plates II and III)

We believed in 1928, when publishing our Fifth Paper of this series* (on the Gryllidae of Colombia) that it would be our last contribution on this country prior to our undertaking a large work on the Santa Marta region, in preparation for which this series has been produced. Since we last published on the various groups, however, so much additional material has been received that a supplementary paper is plainly necessary.

In the present study a series of four hundred and eighty-two specimens are recorded, representing one hundred and three genera, one hundred and twenty-nine species and two subspecies, of which six genera, nineteen species and one subspecies are new. The material treated belongs to the author and is deposited at the Academy of Natural Sciences of Philadelphia unless otherwise noted, excepting a small but important collection, largely from the Department of Antioquia, collected by C. H. Ballou and belonging to that Institution. In that collection we were particularly interested to find two species described by Stål, which had not been subsequently recorded. These are the Antioquian *Aristia mordax* and *Trichotettix pilosula* (the monotypic genotype). We are once more deeply indebted to Hermano Apolinar Maria of the Instituto de la Salle, Bogotá, who again has sent us material of great importance in our studies.

The following table is compiled from the present series of papers, in which three hundred and ninety-six species have been discussed.

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* Trans. Amer. Ent. Soc., LIV, pp. 79 to 124, (1928).

Origin	Dermapt	Blattidae	Mantidae	Phasmidae	Acrididae	Tettigoniidae	Gryllidae
Colombia exclusively	4	30	6	33	45	41	19
South America	2	24	10	3	26	32	6
North America	0	10	4	0	15	14	7
North and South America	3	12	7	1	16	11	15
Total	9	76	27	37	102	98	47

In our last paper forty-seven instead of eighty-nine should have been given as the number of species known only from North America and Colombia, the present paper increasing that total only to fifty, this very small addition being undoubtedly due to the fact that no material from the Chocó is here recorded.

That twenty new species and races are here described, after so much work in Colombia has already been done, is an index of the vast diversity and richness of the country's fauna. That less than sixteen percent of the species treated were previously undescribed, however, indicates that some of this territory is really much better known than many parts of the American tropics. On the other hand it is certain that very many more than nine species of Dermaptera occur in Colombia. Though still much work remains to be done in Panama, there are already one hundred and six species of Blattidae recorded from that much smaller area and a much larger number of species of that family will also undoubtedly be found in Colombia. The same is true, though probably to a much less degree in some cases, in the other families of the Orthoptera.

When the species of Colombia are much better known, we believe that the groups will find the following sequence in abundance of species in this country; Blattidae, Tettigoniidae, Gryllidae, Acrididae, Phasmidae and Mantidae.

DERMAPTERA

PYGIDICRANIDAE

Pyragra fuscata (Serville)

Muzo, Boyaca, 1921 and 1922, (from A. Maria), 2 ♂, 1 ♀.

These specimens have the tegmina solidly dark brown, the wing pads yellow buff with external margins dark brown.

LABIDURIDAE

PSALINAE

Mandex apolinari (Hebard)

The female type from Pamplona, Santander, was originally referred to *Psalis* in 1919. The author now has a male of *Mandex peruvianum* (Bormans) from southern Peru, which confirms our statement in 1921 that *apolinari* is very closely related and certainly congeneric. At present, without being able to compare the sexes, we can distinguish *apolinari* only by the paler head and much paler occiput and limbs. Bormans described *peruvianum* in 1880, while Burr erected *Mandex* in 1915.

Muzo, Boyaca, 1923, (from A Maria), 2 ♀.

Psalis compacta Hebard

Muzo, Boyaca, 1923, (from A Maria), 2 ♂, 1 ♀.

These specimens are smaller, much more slender and with male forceps less curved than the previously reported material from Soacha and Bogotá, Cundinamarca.

Psalis americana (Beauvois)

Muzo, Boyaca, 1923, (from A. Maria), 2 ♂, 2 ♀.

The tegmina have a very broad band of orange buff. The wings are fully developed. The size of the males differs widely (total length 24.6 and 31 mm).

FORFICULIDAE

FORFICULINAE

Doru lineare (Eschscholtz)

Medellin, Antioquia, XII, 3, 1930, (C H Ballou; in sugar cane), 8 ♂, 7 ♀, 5 juv. Muzo, Boyaca, 1921, (from A. Maria), 8 ♂, 5 ♀. Choachi, Cundinamarca, 1916, (from A. Maria), 4 ♂, 3 ♀. Cunday, Tolima, X, 1916, (from A. Maria), 1 ♀.

All of this series as well as those previously recorded from Colombia have the reduced wings completely concealed by the tegmina. This is particularly surprising as over the species entire distribution, from the United States to Argentina, all the other material we have seen is fully macropterous. A brachypterous Colombian race may be represented, but until adaptations of species of earwigs in the tropics are better understood we believe it would be unwise to propose it.

OPISTHOCOSMIINAE

Neolobophora bogotensis Scudder

Muzo, Boyaca, (from A. Maria), 2 ♂ (very dark; forceps considerably shorter than body); VIII, 1921, (from A. Maria), 2 ♂ (paler and much paler; forceps considerably longer than body).

Rehn in 1922[1] diagnosed this genus and species and recorded part of the present material.

BLATTIDAE

CHORISONEURINAE

Chorisoneura parishi Rehn

Medellin, Antioquia, XII, 3, 1930, (C. H. Ballou; in sugar cane), 3 ♂, 3 ♀, 8 juvs. Villavicencio, Intendencia del Meta, (from A. Maria), 1 ♂.

The Medellin adults are distinctly larger than any others of a considerable series of *parishi* before us. They are moderately pale for the species with a pair of longitudinal slightly darker suffused bands very weakly to prominently indicated on the pronotum. In the immatures these bands are even more conspicuous, continued across the mesonotum and metanotum and forming a suffused border around the abdomen. They have also the caudal margins of the tergites in the paler central area conspicuously dotted with black.

Chorisoneura apolinari new species (Pl II, figs. 1 and 2.)

Two females from the upper drainage of the Magdalena are the first Colombian individuals we have seen of the Pellucida Group, which is widely distributed through the American tropics from southern Mexico to Amazonia.

Males would afford only slight additional aid, as the general type of genitalia in the species of this group is similar. That sex in the allied species is not quite as broad, with organs of flight somewhat longer.

The present species is apparently nearest *panamae* Hebard, differing strikingly in the faint but distinctive marking of the head and pronotal disk, the smaller size and broader form.

Type: ♀; Fusagasuga, Cundinamarca, Colombia. 1924. (From A. Maria.) [Hebard Collection, Type No. 1213.]

Size medium for the genus, form broad. Head broad and decidedly depressed; cheeks convex and convergent ventrad; interocular space slightly narrower than that between antennal sockets. Palpi with fifth joint slightly longer than fourth and distinctly shorter than third. Pronotum transverse, rounded elliptical; cephalic margin slightly more convex above head, caudal margin very feebly convex; discal impressions extremely feeble. Tegmina extending to cercal apices, moderately broad, gradually narrowing to the acute, rounded apex; venation much as in *panamae*, discoidal sectors (12 to 13) strongly oblique. Wings with prominent intercalated triangle and costal veins briefly but strongly clubbed. Supra-anal plate triangularly produced with apex bi-mammate. Subgenital plate briefly cleft meso-distad. Tarsal claws very strongly asymmetrical. Arolia large.

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[1] Trans. Amer. Ent. Soc., XLVII, p. 311.

Lateral margins of pronotum and tegmina transparent with a buffy tinge. Pronotal disk ochraceous tawny with a small meso-cephalic, a larger meso-caudal and on each side a small oblique pre-median marking of buffy; all of these in weak contrast but distinct. Occiput weak ochraceous tawny to between eyes, thence opaque whitish buff; the line between these sharp, transverse, and just below it a narrow line of pale ochraceous tawny extending mesad from eyes but interrupted (or almost disappearing) mesad (probably continuous and distinct in intensively colored material) Tegmina (except outer margins) very finely and evenly but definitely though delicately tessellate with pale ochraceous buff; the veins and veinlets transparent. Antennae, palpi, ventral surface and limbs pale buff; ventral surface of abdomen opaque whitish buff.

The measurements of a female, bearing the same data but taken April, 1921, follow those of the type Length of body 9 and 9.1, length of pronotum 2 2 and 2 3, width of pronotum 3.9 and 4.1 (pressed flat); length of tegmen 8.1 and 8, width of tegmen 3.1 and 3 2 mm

The paratype is carrying an ootheca horizontally. This has the sides supplied longitudinally with fine but sharp carinae which become more widely spaced toward the convex margin, the latter with well spaced rounded serrations.

ECTOBIINAE

ASEMOBLATTANA Strand

In 1929, finding that *Asemoblatta* Hebard 1921 was preoccupied, Strand renamed that genus, which includes the monotypic species *nana* Hebard, known from a single male from Bogotá, Cundinamarca.

RIATIA Walker

This genus was described to include the single species *pallicornis* Walker, from Ega (= Teffe), Amazonas, Brazil, in 1868. Shelford placed it as a synonym of *Anaplecta* in 1906, but examination of the type at the British Museum shows beyond question that a distinct genus is represented, with *Lissoblatta* Hebard, described in 1919, a synonym. The characters which distinguish this genus from *Anaplecta* were not given by Walker, but were fully described for *Lissoblatta*.

Riatia flabellata (Saussure and Zehntner)

Santa Elena, Antioquia, 2400 meters, I, 1, 1930, (Archer and Aguilar), 1 ♂, [A.N S P].

PSEUDOMOPINAE

Ceratinoptera picta Brunner

Cauca, 1 large juv. ♂, [A.N.S.P.].

Dendroblatta sobrina Rehn

Fusagasuga, Cundinamarca, V, 1918, (from A. Maria), 1 ♀. Honda, Tolima, IV, 1918, (from A. Maria), 1 ♀.

Euphyllodromia tupi Rehn

In 1928, when describing *tupi*, Rehn recorded a male from Cauca, Colombia. This male we had recorded as *elegans* Shelford in 1921, but in 1926 had noted that it represented a distinct species.

Pseudomops angusta Walker (or very closely related species)

Villavicencio, Intendencia del Meta, (from A. Maria), 2 adults Colombia, IV, 1912, (C. Wilhelm), 1 ♂, [Hebard Cln]

In the Villavicencio specimens the first has the pronotum with a heavy (though not as extremely heavy as in specimens from Para, Brazil, recorded by Rehn) black transverse arcuate band caudad fusing broadly with the large median black spot; in the second specimen this band is reduced to two latero-caudal oblique areas; the third from "Colombia" is like the first. In all the tegmina are more reddish than in the three from Para, but the third has the humeral vein finely black proximad for over a quarter its length and the adjacent intervals between the veins of the marginal field opaque buff for some distance, and in this specimen the supra-anal plate is more ample but of the same type as in the Para male, produced and deflexed distad with rather broad apex broadly concave. In the first specimen the ventral surface and limbs are blackish except for the usual narrow pale markings, in the second the thorax and trochanters are black (abdomen missing) but the limbs are paler, dark brown; while in the third specimen the thorax and trochanters proximad are black, the rest of the limbs and abdomen bright orange brown. The head is present only in the third individual and is solidly black.

Two Peruvian specimens show other and quite as great color differences and are not similar in some of these.

It is clear that either a large number of closely related species of this small slender type exist or that exceptional individual variation occurs. Large series can alone determine which is the case.

Pseudomops boyacae new species (Pl II, figs 3 and 4)

This is a very striking species, particularly distinguished by its distinctive coloration and color pattern, with pronotum and ventro-proximal section of abdomen brownish orange (the former marked with black meso-caudad), lateral margins of tegmina yellowish buff and distal half of cerci buff, elsewhere being black.

Type—♂; Muzo, Boyaca, Colombia. 1921. (From A. Maria) [Hebard Collection, Type No. 1214.]

Size large, form graceful for the genus, much as in *grata* Rehn. Head narrowly projecting beyond pronotum, deep; space between antennal sockets two-thirds width between eyes; ocellar spots large, the surface just above them more convex than elsewhere. Antennae (from paratype, missing in type) moderately thick and hairy proximad, then becoming distinctly thicker and plumose to end of proximal half, thence much finer. Palpi with third joint intermediate in length between the fourth and (considerably the longest) fifth (ultimate) joint. Pronotum rounded pentagonal, longer than wide, with greatest width meso-caudad; latero-caudal sulci of disk large but broad and shallow; cephalic margin transverse, caudal margin broadly rounded obtuse-angulate produced. Tegmina narrow and very elongate, much surpassing cerci; discoidal sectors six. Wings long and very narrow; ulnar vein with two complete branches. Abdomen with median and first four tergites unspecialized, fifth very deeply and extensively concave with a meso-caudal transverse ridge, before this a prominence and that whole meso-proximal area clothed with coppery hairs; sixth tergite with rounded projecting latero-caudal angles alone visible; two succeeding tergites transverse, narrow, with a fine medio-longitudinal carina. Cerci short for genus, simple, tapering distad from middle with ninth and tenth (terminal) joints small and rounded. Supra-anal plate almost as long as proximal width, sinistral margin the more convex, margins converging and then rounding into the very broadly convex, broad apex; large mesal section of distal portion heavily clothed with procumbent coppery hairs directed cephalad. Subgenital plate decidedly produced, particularly dextrad; distal margin very broadly concave, this concavity strongest sinistrad, the dextral and sinistral apices both rounded and produced, the sinistral the less extensive; a very small style no longer than broad on distal margin sinistrad on inner margin of sinistral apex and a longer style, toothed dorsad on inner margin of dextral apex. Limbs and armament normal for genus.

General coloration shining black, antennae alone dull. Ocellar spots and distal half of cerci, above and below, buff. Pronotum mars orange with two black spots in latero-caudal sulci of disk. Paratype apparently teneral with pronotum more yellowish except mesad, the black spots fusing to form a coarse meso-caudal crescent. Tegmina with a broad stripe of ochraceous orange on costal margin to distal fourth and another slightly narrower submarginal sutural stripe of the same on sinistral tegmen only which disappears slightly further distad. Portion of tegmina concealed when at rest and wings deeply infumate and iridescent with veins black. Abdomen ventrad with a very large spot of mars orange occupying all but the lateral portions of the third, fourth and fifth sternites.

The measurements of a paratypic male bearing the same data follow those of the type. Length of body 13.1 and 14.5 (abdomen exserted), length of pronotum 4.7 and 4.7, greatest pronotal width 4.5 and 4.4, length of tegmen 14.3 and 14.6, greatest width (meso-distal) of tegmen 3.5 and 3.7 mm.

BLATTINAE

Periplaneta brunnea (Burmeister)

Fusagasugá, Cundinamarca, V, 1918, (from A. Maria), 1 ♀ (very small).

Pelmatosilpha subalata (Saussure and Zehntner)

"Santa Fé de Bogotá," 1 ♂, 1 ♀, [Hebard Cln]

These specimens were received in exchange from the Paris Museum, so determined by Chopard. The locality may be indefinite as the material evidently was collected long ago. They were probably taken at a considerable altitude, however, as they are noticeably smaller than the type, a specimen from "Colombia."

They are black, with tegmina and cerci (except for being black at the extreme tips) deep chestnut brown. The ocellar spots, cheeks, palpi and limbs are brownish buff. They are much more slender, less glabrous and have the tegmina distinctly more thickly and definitely impresso-punctulate than *micra* Hebard.

Length of body ♂ 16 (abdomen moderately extruded), ♀ 15.5; length of pronotum ♂ 4 8, ♀ 4.8; greatest pronotal width ♂ 6, ♀ 6; greatest exposed length of tegmen (near sutural margin) ♂ 4.7, ♀ 3.8 mm.

Though the tegmina of the female are truncate and practically quadrate, those of the male have their caudal margins oblique to the considerably more produced rounded distal sutural angle. It is this feature, even more prominent than in the male of *micra*, which induces us to make the present generic assignment, though the species is admittedly almost as logically referable to *Eurycotis*.

Lamproblatta ancistroides Rehn

A female specimen bearing a similar green "Santa Fé de Bogotá" (probably indefinite) label is before us. Lacking palpi it is difficult to determine, but if it represents *ancistroides* this sex differs from *albipalpus* Hebard mainly in the longer and more slender caudal limbs.

Rehn described *ancistroides* in 1930, at which time he placed as this species the specimen from Villavicencio, Intendencia del Meta, which we had referred to *albipalpus* in 1919.

Rehn at that time also described *Lamproblatta gorgonis* from Gorgona Island, off the west coast of Colombia.

NYCTIBORINAE

Paratropes metae Hebard

Villavicencio, Intendencia del Meta, (from A. Maria), 1 ♂ allotype.

This topotypic male has the interocular space slightly wider than in the type female, three-quarters as wide as the interocellar space. The antennae show almost no meso-proximal thickening. The tegmina and wings are distinctly more caudate. The subgenital plate is very pale ochraceous buff with center black. The pronotal cephalic marginal band is baryta yellow (instead of rich ochraceous buff as in the female). Compared with males of *elegans* (Burmeister) it is seen to be a decidedly more elongate, graceful insect.

Length of body 20.8, length of pronotum 5.2, width of pronotum 9, length of tegmen 23, width of tegmen 8.6 mm.

EPILAMPRINAE

Hyphorhicnoda litomorpha Hebard

Antioquia, (from LeMoult), 1 ♂, [Hebard Cln]. Villavicencio, Intendencia del Meta, 1919, (from A. Maria), 1 ♂.

PANCHLORINAE

Pycnoscelus surinamensis (Linnaeus)

St. Andrews Island, IV, 29, 1931, (J. Zetek), 2 ♀, 3 large juv. ♀, [Hebard Cln.].

Panchlora cubensis Saussure

Medellin, Antioquia, V, 26, 1930, (C. H. Ballou), 1 ♂, 1 ♀.

Panchlora exoleta (Burmeister)

Medellin, Antioquia, V, 26, 1930, (C H. Ballou), 1 ♀.

Tribonium colombicum new species (Pl. III, fig. 1)

This is a small species of the genus, nearest *guttulosum* (Walker) but easily distinguished from any previously known by the solid buff and blackish markings with no tessellation whatever indicated.

It agrees with *guttulosum* and differs from *conspersum* (Guerin and Percheron) and *spectrum* (Eschscholtz) in having the marginal field of the tegmina unspecialized proximad.

Type.—♂; "New Grenada" (= Colombia in its broader sense). [Hebard Collection, Type No. 1215.]

Size small for the genus, form normal, broad. Head greatly flattened, rounded margins. Eyes separated by an interspace very slightly greater than that between the small ocellar spots. Pronotum moderately cucullate over occiput which it leaves narrowly exposed; decidedly transverse, its rounded lateral angles scarcely caudad of a median point; surface rather thickly and very finely impresso-punctulate; impressions, particularly those latero-cephalad and a fine medio-longitudinal sulcus prominent. Organs of flight fully developed, well surpassing apex of abdomen. Abdomen as characteristic of genus. Femora small, wholly unarmed. Tarsi short; caudal metatarsus (in paratype, missing in type) unarmed, with a large distal pulvillus, other joints with large pulvilli. Arolia not large.

Generally shining blackish brown. Pronotum cinnamon buff with very narrow lateral and broader caudal margins and a median almost square area (the cephalic angles of which are briefly produced laterad) shining blackish brown. Tegmina with entire marginal field cinnamon buff except for an oblique suffusion which crosses it mesad, and all but margins of anal field cinnamon buff, other portions shining blackish brown. Abdomen rather broadly margined dorsad and ventrad with cinnamon buff.

The measurements of a paratypic male, bearing the same data, follow those of the type. Length of body 17 and 16.7, length of pronotum 4 and 3.9, greatest pronotal width 6.8 and 6.6, length of tegmen 15.5 and 15.3, greatest width of tegmen 5 and 5 mm.

Lauxoblatta emarginata (Burmeister)

Antioquia, (from LeMoult), 2 ♂ (teneral), [Hebard Cln]

We inadvertently proposed this generic name,[2] Rehn's discussion of the genus which had been incorrectly referred to as *Zetobora* and which he was naming *Lanxoblatta* not yet having appeared.

Lauxoblatta frater new species (Pl II, fig 5)

This insect in coloration closely resembles *L. emarginata* (Burmeister), described from Pará, Brazil, of which a series is before us. It is, however, much larger with pronotum deeper and nodulose instead of coarsely punctate laterad, while the tegmina are proportionately broader particularly distad at the more broadly rounded apices.

Even closer affinity is shown to *L. martinezi* Bolivar, described from a female from Archidona, Ecuador. The present insect is distinguished only by the pronotal cucullation showing no radiating rugae (formed by confluent granules) and in the female sex there is no emargination of the pronotal margins just back of the lateral angles [3]

Type.—♂; Antioquia, Colombia. (From LeMoult.) [Hebard Collection, Type No. 1216.]

Size large and form broad for the genus. Head flattened, a transverse depression arcuate ventrad between ocellar spots, small, contour rounded. Eyes separated by a distance about two-fifths width between antennal sockets Ocellar spots small. Pronotum extending well beyond head and cucullate in mesocephalic portion, defined from elevated lateral and caudal portions by a distinct sulcus; coarse, irregular but distinct humeral carinae present; cephalic margin broadly convex to lateral angles situated mesad, caudal margin with a small concave section just back of these, thence broadly convex with angulation indicated at the shoulders; surface coarsely nodulose becoming more heavily so laterad, cucullate portion much smoother and weakly impresso-punctulate, pale area flanking it almost smooth with a few scattered nodules. Scutellum bluntly medio-longitudinally carinate and weakly impresso-punctulate. Organs of flight well surpassing abdomen; tegmina very broad, showing particularly little narrowing distad. Abdomen as characteristic of genus, dorsal tergites laminate produced laterad. Limbs short. All femora entirely unarmed except ventro-cephalic margin of cephalic which distad bears a short row of minute spiniform hairs. Tarsal joints short, unarmed with ventral surface occupied by large pulvilli. Arolia of moderate size.[4]

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[2] Konowia, x, p. 259, (1931)

[3] The supra-anal plate is emarginate mesad in both sexes of all species of *Lauxoblatta* and its allies, many of which are as yet undescribed, never entire as figured for *martinezi* by Bolivar in 1884

It is evident to us that either a multitude of species exist or the species are subject to remarkable individual variation.

Allotype.— ♀; same data as type. [Hebard Collection.]

Agrees extremely closely with male. Pronotum lacking brief concavities of the margin just caudad of the lateral angles. Interocular space slightly over two-fifths width between antennal sockets.

General coloration shining bay, deepest on pronotum. Antennae not annulate distad (apparently usually but not always annulate in *emarginata*). Pronotum with depressed section laterad and cephalad of cucullation buff faintly tinged with tawny. Ocellar spots and parts of mouthparts buffy.

♂	Length of body	Length of pronotum	Width of pronotum	Length of tegmen	Greatest (meso-distal) width of tegmen
L. frater Type.	27	8	12.7	22.4	10.3
L. emarginata					
St. Jean du Maroni, French Guiana	21.2	6	10.7	20.8	8
♀					
L. frater Allotype.	29.8	8.7	13 1	23	10.8
L. emarginata					
La Forestière, French Guiana	23	6.7	12	20 3	8.8

In addition to the described pair, two male paratypes bearing the same data are before us.

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[4] The characters of the abdomen and limbs probably have generic significance only.

Lauxoblatta lata (Shelford)

Muzo, Boyaca, 1921, (from A. Maria), 2 ♂.

A somewhat smaller female labelled "Bogotá, H. E. Klages" sent for examination from the National Museum probably came from a nearby valley at a much lower elevation. It was recorded by us as *Zetobora lata* in 1919.

The present specimens agree closely with Shelford's description of a male from an unknown locality except in being distinctly smaller, as shown by the pronotal measurements.[5]

The specimens recorded by us measure: Length including tegmina ♂ 27.8 and 30.3, ♀ 26.6; length of pronotum ♂ 8 and 8.7, ♀ 8.2; width of pronotum ♂ 12.8 and 13.8, ♀ 13; length of tegmen ♂ 21.8 and 22.7, ♀ 20.7; width of tegmen ♂ 10.8 and 10.8, ♀ 10 mm.

The strikingly bicolored tegmina, blackish liver brown and transparent ochraceous buff, are distinctive. The pronotal granulation is even heavier and coarser than in *frater* here described but the cucullate portion shows scarcely any extremely minute impressed punctulae.

BLABERINAE

Blaberus discoidalis Serville

Llanos de San Martin, Intendencia del Meta, 1 ♂.

Eublaberus biolleyi Rehn

Villavicencio, Intendencia del Meta, (from A. Maria), 1 ♀.

This specimen has the pronotal markings heavy, solidly fused, covering the escutcheon except for a median pale area.

CORYDIINAE

Hypercompsa xanthosticta new species (Pl. II, fig. 6)

This beautiful little species agrees with the other known species but differs from the Colombian *H. anolaima* Hebard in having the anal field of the tegmina without a dividing vein. It is distinguished from all by the more numerous and extensive golden brown markings.

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[5] The total length for that specimen was given as 22, probably in error for 32 mm.

Type.—♀; Medellin, Antioquia, Colombia. December 10, 1930. (C. H. Ballou.) [Acad. Nat. Sci. Phila., Type No. 5514.]

Size large, form normal for this genus of very small robust species. Tegmina and wings well surpassing apex of abdomen. Pronotum decidedly transverse, the width decidedly greatest caudad; angles very broadly rounded the latero-cephalic showing angulation, the latero-caudal not showing angulation; cephalic and caudal margins transverse, the latter with very faint convexity indicated. Tegmina with venation as characteristic of the Brazilian genotype *H. fenestrina* Saussure. Cerci (damaged) with strongly defined rounded joints. Supra-anal plate subbilobate. Subgenital plate valvular.

Head, palpi and pronotum blackish brown with a coppery pilage, the caudal margin of the latter dull gold, this margin quite broad laterad. Antennae dull gold with a meso-proximal annulus of dark brown which extends over nine joints. Tegmina with marginal field (this broad proximad and distad) and longitudinal margins of anal field broadly opaque, blackish brown with a coppery pile; other portions transparent, weakly tinged with golden brown. Mesonotum and metanotum blackish, with two large oval areas of yellow buff which show through the fenestrate portions of the anal fields. Abdomen yellow buff with apex dark brown, so that showing through the fenestrate portions of the tegmina they appear golden brown with a meso-distal dark band. Abdomen ventrad buffy in proximal portion, remaining portions and limbs deep prouts brown. Cerci yellow (apices missing).

Length of body 6.2, length of pronotum 1.9, width of pronotum 2.9, length of tegmen 6.2 mm.

PERISPHAERINAE

ANTIOQUITA new genus

This genus is erected to include the single species *punctigera* here described. It is nearest *Colapteroblatta* Hebard, differing in the sexes being similar, with subcucullate pronotum, equally reduced tegmina and evenly convex abdomen, the pronotum and tegmina being very thickly impresso-punctate and the abdomen very thickly impresso-punctulate above and below. Even the head and limbs show scattered impressed punctulations.

These genera agree in the supra-anal plate of the male being bilobate and very delicate, of the female showing a mere trace of bilobation and heavily chitinous; the heavy limbs with few but heavy spines and short unarmed tarsi with large pulvilli and arolia.

Antioquita punctigera new species (Pl. II, fig. 7)

In many ways this species quite closely resembles certain species of the Epilamprinae such as "*Audreia*" *hamiltoni* (Rehn). It has a decidedly more Epilamprine appearance than any other of the South American species of the Perisphaerinae. We can not avoid the question as to whether all of the tropical American species now assigned to the Perisphaerinae are not actually members of the Epilamprinae, highly specialized to the extent that spines have in large part disappeared from the ventral margins of the caudal femora, while in some cases specialization of the pronotum hitherto unrecognized in the Epilamprinae is found. If such is the case, however, the characters which have been hitherto recognized to distinguish these subfamilies will require decided modification.

Type.—♂; Antioquia, Colombia. (From LeMoult.) [Hebard Collection, Type No 1217]

Size medium for the group; form elongate elliptical, not broad. Head very briefly projecting beyond cephalic margin of pronotum, face flattened; eyes reduced, not projecting; interocular space broad, slightly narrower than that between antennal sockets. Ocellar spots moderately large. Palpi short. Pronotum with greatest width caudad; latero-caudal angles rounded subrectangulate, caudal margin transverse, very broadly concave on each side and very feebly obtuse-angulate rounded produced mesad Tegmina slightly longer than broad, truncate distad with disto-sutural angle slightly produced and more sharply rounded than disto-costal angle. Caudal margins of dorsal abdominal tergites supplied with (up to 17) numerous small nodes. Subgenital plate produced as an asymmetrical lobe; dextral style longer than the sinistral. Ventro-cephalic margin of cephalic femur armed with an elongate row of minute piliform spines, terminating in a single (two in female) elongate spine. Ventro-cephalic margins of other femora with very few but ventro-caudal well supplied with stout spines.

Allotype.—♀; in orchids loaded on ship at Puerto Colombia, Colombia. Taken by H. B. Shaw at New York quarantine in 1914. [Hebard Collection.]

Very similar to male but considerably larger with dorsal convexity of abdomen decidedly stronger. Interocular space slightly greater than that between antennal sockets. Tegmina with exposed portions slightly wider than long, with angles similarly rectangulate but the disto-sutural very sharply, the disto-costal broadly rounded.

Occiput, very narrow cephalic margin of pronotum, broad lateral margins of same (becoming broadest caudad) and mediastine field of tegmina buffy, very thickly punctulate with chestnut brown; other portions of pronotum and tegmina almost solidly chestnut brown. Abdomen blackish brown with very minute inconspicuous maculations of buffy in male, of hazel in female (the latter being more reddish particularly there); four longitudinal darker bands are present ventrad and two such are suggested dorsad in the female. Face blackish chestnut brown, this suffusing the interocular area. Ocellar spots, genae, palpi and limbs buffy, the punctae on the latter tawny or russet. Antennae russet.

Length of body ♂ 18, ♀ 22.3; length of pronotum ♂ 5.1, ♀ 6; width of pronotum ♂ 7.1, ♀ 8.7; exposed length of tegmen ♂ 5.6, ♀ 5; width of tegmen ♂ 5.3, ♀ 6.1 mm.

MANTIDAE

THESPINAE

Musonia surinama (Saussure)

Medellin, Antioquia, VII, 22, 1930, (L. Aguilar), 1 ♂, [A.N.S.P.]. Choachi, Cundinamarca, IX, 1916, (from A Maria), 1 ♂.

Thespis metae Hebard

Susumuco, Cundinamarca, 2600 feet, XII, 1919, (from A. Maria), 2 ♀ (green).

These are the first known females of this species. They are separable from those of the very closely related *T. media* (Giglio-Tos) mainly by the head, which in this sex of *metae* is distinctly deeper and narrower.

PSEUDOMIOPTERYGINAE

Pseudomiopteryx bogotensis Saussure

Choachi, Cundinamarca, VII, 1915, (from A. Maria), 1 ♂.

Like a male recorded by us from San Antonio, Cauca, in 1919, this specimen has a dark medio-longitudinal band on the pronotum. It is very probable that Giglio-Tos' *decipiens*, described from Colombia, may be based merely on this not striking color phase.

Pseudomiopteryx colombica Giglio-Tos

Susumuco, Cundinamarca, I, 1920, (from A Maria), 1 ♂.

This specimen is no larger than the preceding and somewhat smaller than Giglio-Tos' type from "Colombia." Larger series may show the name to be based on a mere color phase of *bogotensis*, but this can at present not be determined.

LITURGOUSINAE

Liturgousa cayennensis Saussure

Villavicencio, Intendencia del Meta, 1925, (from A. Maria), 1 ♀.

CHOERADODINAE

Choeradodis rhombicollis (Latreille)

1833. *Mantis rhombicollis* Latreille, in Humboldt and Bonpland, Obs Zool., II, p. 103, pl 39, figs. 2 and 3. (No locality given.)

1931. *Choeradodis columbica* Beier, Mitt. Zool. Staatsinst. und Zool. Mus. Hamburg, 45, p. 16. [♂, Colombia]

Had Beier noted our comments on *rhombicollis* in 1923,[6] we can hardly believe that the synonym *columbica* would have been proposed. From Beier's description of the pronotum, his specimen is seen to be representative of *rhombicollis*. The reduction of the marking of the internal surface of the cephalic tibia to a "small black spot" indicates very decided recession in his specimen but nothing more.

To attempt to place such a specimen as representative of an undescribed species belonging to a different section of the genus on the basis of the reduction of the tibial marking, a feature now so well known to be subject to very decided individual variation, indicates either lack of knowledge of the literature or failure to accept conclusions which were reached after detailed study of many specimens. Decided individual variation in marking is well known by up to date biologists to occur in many species and to persist in adding to the errors of the past by describing as a distinct species a specimen merely showing one of the individual variations in such marking is deplorable.

MANTINAE

Stagmomantis theophila Rehn

1904. *Stagmomantis theophila* Rehn, Proc. U. S. Nat. Mus., XXVII, p. 563. [♂; Turrialba, Costa Rica]

1925. *Stagmomantis denticollis* Werner, Konowia, IV, p. 163. [♂; Huasco and Muzo, Colombia.]

As we had in 1923 published the synonymy of *Stagmatoptera insatiabilis* Rehn 1904 (♀ ; Turrialba, Costa Rica), *Stagmomantis denticulata* Chopard 1916 (♂; Chimbo, Ecuador), and *Stauroman-*

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[6] Trans. Amer. Ent. Soc., XLVIII, p. 338.

tis festae Giglio-Tos 1917 (♂, ♀; Guayaquil and Vinces, Ecuador), it is rather surprising to find that two years later Werner has erected another synonym, *denticollis*.

With three other prior descriptions of the male of this species in the literature and the published information that its distribution included Colombia, we can not help wondering how that author failed to assign his males correctly. His description is brief, but sufficient features are given to place the material definitely as *theophila*.

ACONTIOTHESPINAE

Tithrone roseipennis Saussure

Santa Elena, Antioquia, IX, 14, 1930, (J. Ramirez), 1 ♂, [A.N.S.P.].

EPAPHRODITINAE

Acanthops falcata Stål

Muzo, Boyaca, 1924, (from A. Maria), 1 ♀. Villavicencio, Intendencia del Meta, (both from A. Maria), 1921, 1 ♂; VIII, 1915, 1 ♀.

These females have the pronotum appreciably more thickly granulate than the Panamanian females we have recorded as *falcata*. The latter would be referable to *griffinii* Giglio-Tos, but we think that name should probably be considered a synonym; certainly not more than a race is represented.

Acanthops tuberculata Saussure

Muzo, Boyaca, 1922, (from A. Maria), 1 ♀.

This is a large, handsome specimen.

VATINAE

Catoxyopsis dubiosa (Giglio-Tos)

Villavicencio, Intendencia del Meta, (from A. Maria), 1 ♀.

This rare and magnificent species, described from the valley of Santiago, Ecuador, is also represented in the Academy collection by a female from the Napo River, Oriente, Ecuador, at an elevation of 440 meters.

Phyllovates chlorophaea (Blanchard)

Medellin, Antioquia, VII, 20, 1930, (S. and C. H. Ballou), 1 ♀.

Vates festae Giglio-Tos

Pensilvania, Cordillera Central, Caldas, 1921, (from A. Maria), 1 ♂.

This specimen agrees closely with a male from Macas, Oriente, Ecuador, taken at 1050 meters, now in the Academy collection. Its measurements are given last. Length of body 59 and 56.4, length of pronotum 20.7 and 20, greatest width of pronotum 5.6 and 5.6, length of tegmen 50.1 and 50, greatest width of tegminal marginal field 2.8 and 2.8, length of cephalic coxa 10.8 and 10.6 mm.

This handsome species was described from a female from Gualaquiza, Ecuador in 1914.

Zoolea lobipes (Olivier)

Villavicencio, Intendencia del Meta, (from A. Maria), 1 ♀.

PHASMIDAE

ANISOMORPHINAE

Autolyca bogotensis (Goudot)

Bogotá, Cundinamarca, (from A. Maria), 3 ♂, 3 juv.

PSEUDOPHASMINAE

Citrina venilia (Westwood)

Villavicencio, Intendencia del Meta, 1922, (from A. Maria), 1 ♂.

BRACHYELENA new genus

This genus is proposed to include, as the genotype, the single species, *Brachyelena hirsuta*, here described. Though found to be a member of the Section Stratocles, nearest *Eucles* Redtenbacher, the present insect rather resembles an exceptionally heavy species of the genus *Pseudophasma*.

Form extremely robust for the group. Four caudal femora lacking a medio-longitudinal ventral carina, unarmed. Ocelli present. Tegmina short, rounded. Wings well developed but not reaching apex of abdomen (in female sex, male unknown). Operculum extending as far as supra-anal plate. Cephalic femora straight with heavy carinae, neither compressed nor showing proximal curvature. All tibiae sulcate dorsad.

Brachyelena hirsuta new species (Pl. II, fig. 8)

Closest resemblance, though purely superficial, is to the Colombian *Pseudophasma robusta* Hebard, the present species differing not only in numerous generic features but also in being more robust, more hirsute, with immaculate antennae, large eyes, unarmed mesonotum with lateral marginal carinae, tegmina with much less pronounced shoulders, tegmina and wing venation similar but with much more regular transverse veinlets finely but distinctly paler and limbs with proximal portions of femora alone very slightly paler than the other portions.

Type.— ♀; Santa Elena, Antioquia, Colombia. December 28, 1930. (Aguilar and Ballou.) [Acad. Nat. Sci. Type No. 5514.]

Size large, form extremely robust for this group. Head broad, occiput evenly convex and hirsute; the three minute ocelli forming a triangle slightly wider than long, a concave impression below the median ocellus. Pronotum hirsute, simple. Mesonotum hirsute and unarmed, short, with a fine medio-longitudinal carina suggested and a definite carina at the oblique margin on each side. Tegmina reduced, short; shoulders inconspicuous with outline rounded obtuse-angulate; caudal margin rounding into sutural margin at almost a rightangle. Veins of exposed portions of tegmina and wings quite regular, connected by a multitude of unusually regular cross-veinlets. Body and limbs hirsute. Eighth tergite slightly and bluntly raised meso-distad, ninth with a very short carina before its apical emargination, into which fits the very small supra-anal plate. Cerci prominent, extending beyond apex of supra-anal plate. Operculum produced an equal distance, lateral margins convex-convergent to the acute apex. Limbs distinctly longer and very slightly heavier than in *Pseudophasma robusta.* Tarsi very heavily hirsute ventrad, the large distal pulvilli of the four proximal joints not concealed. Moderately large arolia present.

General coloration blackish mummy brown. Wing veins finely dresden brown, tegminal veins and veinlets and wing veinlets very finely but conspicuously paler, buckthorn brown. Wings with radiate field immaculate, heavily tinged with bister. Eye dresden brown. Abdomen with proximal tergites latero-caudad cinnamon brown with immediate margins there very briefly buffy. Femora slightly paler, prouts brown, in proximal half.

Length of body 51, dorsal surface of head 4, pronotum 5.3, mesonotum 6.3, tegmen 7.7, wing 25.8, cephalic femur 19.8, median femur 15.7, caudal femur 21.6; width of head 4.8 (across eyes) 5.3, pronotum 4.3, mesonotum 4.8, dorsal fields of tegmina 3.3 mm.

Pseudophasma flavidum new species (Pl. II, fig. 9)

The generally pale coloration, yellow or yellowish, antennae very heavily annulate, tegmina with discoidal field (intermediate area of Brunner) smooth but not wholly velutinous, its lateral margins alone black and limbs pale and immaculate readily distinguish this very handsome species. The highly asymmetrical specialization of the male poculum is an unusual feature.

Type.—♀; Guaicaramo, Intendencia del Meta, Colombia. 1926. (From A. Maria.) [Hebard Collection, Type No. 1218.]

Size moderately large, form moderately robust for the genus. Head moderately broad, distinctly longer than wide; occiput smooth. The three ocelli very small, not closely crowded, forming an equilateral triangle; the depression below the median ocellus deep, transverse. Pronotum smooth, showing a few very low tubercles in caudal portion. Mesonotum short, medio-longitudinally weakly sulcate, this bounded by very low carinae; surface well supplied with very low tubercles and on each side with a row (3 to 7) of small acute conical projections. Tegmina with shoulders slightly elevated, compressed, rather broadly rounded at slightly more than a rightangle, discoidal field with venation practically obsolete, sharply delimited from other fields in color, venation elsewhere forming a network; caudal margin rounding into sutural margin at almost a rightangle Wings reaching to base of apical portion of abdomen; veins quite regular, with a multitude of very regular cross-veinlets. Cerci prominent, extending briefly beyond apices of equally projecting supra-anal plate and operculum. The latter with lateral margins convex-convergent to the acute apex Cephalic femora with cephalic flexure moderately decided; all femora and tibiae with four carinae conspicuous, meso-ventral carina of median and caudal femora low but distinct and supplied with hairs. Tarsi as here given for *Brachytelena hirsuta*.

Allotype.—♂; same data as type. [Hebard Collection.]

Very similar to type but considerably smaller and less robust. The three ocelli form a triangle slightly deeper than wide. Pronotum with tubercles subobsolete (obsolete in several paratypes), but specialization of mesonotum fully as decided. First of last three tergites slightly shorter than the penultimate, which is equal in length to the ultimate, the latter with distal margin thickened and feebly bilobate, mesad slightly impressed on each side of a very brief rounded medio-longitudinal distal carina. Poculum very large: eighth sternite large and convex, dextrad produced in a large projection to near apex of ninth sternite, this projection with a median flattened process, slightly deeper than wide, with margins evenly rounded, directed ventrad and curved slightly inward (thus closely embracing the ninth sternite to below the flaring dorsal margin of the latter; ninth sternite showing slightly greatest production meso-proximad, thence with sides convex ascending to the free dorsal margin which flares broadly and decidedly and curves to its truncate distal portion.

Generally cream color, the tegmina and wings more yellow, mustard yellow. Discoloration is indicated and in life the head, pronotum and mesonotum may be more yellowish. Antennae proximad cream color with apices of joints black, becoming black distad with very widely spaced annuli of cream color. Tegmina with discoidal field outlined on outer side of anal vein and inner side of humeral trunk with black. These the only markings, but very striking.

The Villavicencio series is decidedly more intensive. The specimens have limbs and body strongly suffused with vinaceous russet, the head with suffused interocular longitudinal dark bands continued on pronotum and mesonotum and often post-ocular parallel lines, the tegmina and wings suffused with vinaceous russet, the discoidal field sometimes solidly that color, the transverse veinlets sometimes yellowish and often with lateral portions of intervals between the veins the same. In the female the tegmina and wings are generally mustard yellow except for the vinaceous russet discoidal field and its invariably black lateral margins.

The measurements of the largest male and smallest female, both from Villavicencio, follow those of the type and allotype. Length of body ♂ 50 and 53.5, ♀ 67.2 and 60; length of pronotum ♂ 3 2 and 3.2, ♀ 5.2 and 4.8; length of mesonotum ♂ 5.1 and 5.2, ♀ 7.1 and 6.6; length of tegmen ♂ 7.1 and 6.8, ♀ 9.8 and 8.7; length of wing ♂ 35.7 and 34, ♀ 43.2 and 40; length of cephalic femur ♂ 17.5 and 19.7, ♀ 21.6 and 17; length of caudal femur ♂ 17.5 and 19.2 mm.

Specimens Examined.—13; 10 males and 3 females.

Muzo, Boyaca, 1921, (from A. Maria), 1 ♂. Guaicaramo, Intendencia del Meta, VI, 1925, 1926 and 1930, (from A. Maria), 3 ♂, 2 ♀, *type, allotype, paratypes.* Villavicencio, Intendencia del Meta, 1921, (from A. Maria), 6 ♂, 1 ♀, *paratypes.*

Metriotes diocles Westwood

Villavicencio, Intendencia del Meta, 1912, (from A. Maria), 1 ♂.

The tubercles bordering the mesonotum laterad are more numerous and heavier but its surface is less rugulose than in a male previously recorded by us from Paramba, Ecuador.

ISAGORAS Stål

It is now evident that a number of species, closely resembling but actually widely distinct from *plagiatus* Redtenbacher, actually exist. These insects are slightly streaked gray-brown, dull and not at all nitid, with shoulders of tegmina never undulate and mesonotum weakly to distinctly tuberculate and weakly to distinctly medio-longitudinally sulcate in males.

As we stated in 1921, Redtenbacher's series assigned to *phlegyas* (Westwood) probably includes more than one species and this now appears highly probable for his *plagiatus* as well. We consider it best to here restrict that name, by choosing southern Brazil as type locality (Rio de Janeiro and Espirito Santo) and believe Chopard's Guianan material so recorded is distinct, differing in the decidedly shorter tegmina and wings[7] and probably other much more important features among those given below. We consequently here name that undescribed species *chopardi*.

A key to the males before us is necessary in so complex a problem.

A. Dorsal surface bister showing bark-like streaking only distad on wings. Tegmina with a median transverse arcuate band of buff across shoulders. (Ocelli moderately large, forming a transverse triangle. Occiput and pronotum showing very few minute blunt tubercles. Metanotum similar with scattered larger tubercles and a weak medio-longitudinal sulcus. Tegmina very short (length 4.1 mm.) with shoulder distinct, broadly rounded rectangulate. (Apex of abdomen missing.)) Boca Murindo, Choco, Colombia.
Isagoras chocoensis Hebard[8]

AA. Dorsal surface gray-brown, showing bark-like streaking; tegmina without any band.

B. Subgenital plate without lateral arms. Tegmina moderately elongate

C. Ocelli weakly indicated, forming a triangle longer than wide. Antennae distinctly annulate. Occiput and pronotum showing very few minute blunt tubercles. Metanotum much more thickly tuberculate, with two dark spots on each side including slightly larger tuber-

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[7] See Trans. Amer. Ent. Soc., XLVII, p. 164, footnote 62, (1921).

[8] Quite possibly Redtenbacher's specimens, referred to *plagiatus*, from Bogotá, Colombia and Chiriqui, Panama, represent this species.

cles, longitudinal ridges so decided that the weak medio-longitudinal sulcus is inconspicuous. Tegmina of medium length (5.5 mm.), with shoulders broadly rounded rectangulate, apices very broadly convex, truncate. Eighth tergite with latero-caudal angles moderately produced, well rounded sub-rectangulate; ninth short, its dorsal length no more than that of eighth. Subgenital plate cup-like, medio-longitudinally very strongly carinate, its free dorso-distal margins convex to the (damaged but apparently almost acute) apex. Muzo, Boyaca, Colombia.
Isagoras apolinari new species

CC. Ocelli prominent, forming an equilateral angle. Antennae not annulate. Occiput and pronotum showing distinct though small tubercles. Metanotum with similar tubercles, some larger tubercles, a network of longitudinal ridges and a strong medio-longitudinal sulcus. Tegmina elongate for genus (9 mm.), with shoulders very sharply rounded rectangulate, apices broadly rounded but showing no truncation. Eighth tergite with latero-caudal angles not produced and very sharply rounded rectangulate; ninth tergite a little longer than the eighth. Subgenital plate cup-like, medio-longitudinally very strongly carinate, distad deeply cleft mesad, the lateral portions forming two rounded projections. Paramba, Imbabura, Ecuador
Isagoras ecuadoricus new species

BB. Subgenital plate with lateral arms. Tegmina very short.

C1. Subgenital plate with lateral arms like claspers, undulating, produced, with spatulate apices curving inward to meet beyond apex of subgenital plate. Ocelli prominent, forming an equilateral triangle. Occiput and pronotum almost smooth, showing a few very minute tubercles. Metanotum similar and with very weak ridges and slightly larger tubercles, the medio-longitudinal sulcus distinct. Tegmina with shoulders rounded rectangulate. Ninth tergite slightly shorter than eighth. Cerci distinctly shorter than eighth tergite. St. Laurent du Maroni, French Guiana.
Isagoras chopardi new species

CC1. Subgenital plate with lateral arms with ventral margins narrowly lamellate, distad curving inward and downward and not reaching apex of subgenital plate. Ocelli not prominent, forming a triangle longer than wide. Occiput and pronotum smooth. Metanotum similar, with a few small tubercles laterad and a fine medio-longitudinal sulcus present. Tegmina with shoulders very weakly developed, rounded obtuse-angulate. Ninth tergite much shorter than eighth. Cerci moderately elongate, distinctly longer than eighth tergite. Nouveau Chantier, French Guiana.

Isagoras affinis Chopard

Isagoras apolinari new species (Pl. II, figs. 10 and 11)

This insect may be readily separated from *ecuadoricus*, its nearest relative, by the characters given in the above key.

Type.—♂; Muzo, Boyaca, Colombia. 1921. (From A. Maria.) [Hebard Collection, Type No. 1221.]

Limbs unarmed, the cephalic and median very short. Antennal annuli suffused light and dark brown, paling distad. Pronotum with a meso-caudal dark fleck. Lateral spots on mesonotum very dark but not conspicuous, the small tubercle in each paler. Limbs mottled, the femora darker than the tibiae and tarsi.

Length of body 47, length of pronotum 2.2, length of mesonotum 7.8, length of tegmen 5.5, length of wing 30.9, length of cephalic femur 8.7, length of caudal femur 10.9 mm.

Isagoras ecuadoricus new species (Pl. II, fig. 12)

We recorded the present specimen as *plagiatus* Redtenbacher in 1924,[9] there noting the differences from Guianan material so recorded by Chopard (actually representing *chopardi* here described.

Type.—♂; Paramba, near Rio Mira, Imbabura, Ecuador. [Acad. Nat. Sci. Phila., Type No. 5518.]

Additional to the characters in the key are: Limbs unarmed but caudal femora with ventral margins showing caudad a few very small low convexities which become larger distad, cephalic longer than caudal. Antennae uniform tawny olive. Occiput similar, pronotum darker and other portions of body considerably darker, bister, a little streaked.

Length of body 53.5, length of pronotum 2.8, length of mesonotum 7.3, length of tegmen 9, length of wing 32, length of cephalic femur 13, length of caudal femur 10.8 mm.

Isagoras chopardi new species (Pl. II, fig. 13)

This species is nearest *affinis* Chopard, readily distinguished by the characters given in the accompanying key. The remarkable claspers laterad of the male subgenital plate particularly distinguish it from *apolinari*, which it resembles closely in many ways.

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[9] Proc. Acad. Nat. Sci. Phila., LXXLI, p. 138.

Type.—♂; St. Laurent du Maroni, French Guiana. (Received in exchange from Chopard.) [Hebard Collection, Type No. 1222.]

Additional characters are;—Limbs unarmed; cephalic and median very short, caudal even shorter.

Allotype.— ♀ same data as type. [Hebard Collection.]

Considerably larger than male, tuberculation and sulcation decidedly heavier. Operculum coarsely and strongly mediolongitudinally carinate, apex truncate with four triangular projections of which the median pair are the largest. Ovipositor valves projecting well beyond operculum.

Antennal annuli suffused and weak, less evident than in *apolinari*. Degree of longitudinal mottling on wings individually variable, but apparently more pronounced in females.

Length of body ♂ 51.5, ♀ 70; length of pronotum ♂ 2.2, ♀ 3.7; length of mesonotum ♂ 6.8, ♀ 9; length of tegmen ♂ 4.7, ♀ 7.2; length of wing ♂ 28.2, ♀ 42.7; length of cephalic femur ♂ 9.8, ♀ 12; length of caudal femur ♂ 8.4, ♀ 9.7 mm.

Two males and a female, paratypes, are in the author's collection. The measurements of the extremes in this series have been given.[10]

Damasippus zymbraeus (Westwood)

Aguadita (near Fusugasuga), Cundinamarca, VI, 1918, (from A. Maria), 1 ♂.

This specimen is considerably larger than Redtenbacher's male from Magdalena. Length of body 33.7, length of tegmen 12.7, length of wing 21.8[11] mm.

A male from Minca, Magdalena, in the Academy collection is only slightly smaller; length of body 31 mm.

HETERONEMIINAE

Libethra straminea new species (Pl. III, fig. 2)

This species agrees so closely with *reservata* (Brunner) in size, form, coloration and most features of structure that, due to the inadequate original description, we recorded the present specimen as that species in 1921.[12]

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[10] Trans. Amer. Ent. Soc., XLVII, p , 164, footnote 62, (1921).

[11] The male wing length given by Redtenbacher is 38.2, probably in error for 18.2 mm.

[12] Trans. Amer. Ent. Soc., XLVII, p. 166.

A specimen of true *reservata* now before us shows that species to be slightly larger with longer limbs, the head decidedly less elongate (slightly shorter than the pronotum), the abdomen lacking supplementary carinae distad, the eighth tergite much more elongate (nearly three times as long as the ninth) and the cerci even shorter and more roundly incurved.

Type.—♂; Bogotá, Cundinamarca, Colombia. September, 1918. (From A. Maria.) [Hebard Collection, Type No. 1224.]

Size small, form slender for the genus. Head unusually elongate and slender, nearly half again as long as pronotum. Length of eye contained in that of cheek slightly over three times. Surface smooth, abdomen distad with weak longitudinal carinae, the medio-longitudinal carina becoming prominent on seventh and eighth tergites and alone present on ninth tergite. Ninth tergite almost as broad as long, dorsal surface distinctly inflated on each side. Cerci stout, strongly in-bent, tapering in that portion strongly to the blunt apices and thickly supplied with short stout chitinous teeth. Poculum small, moderately inflated, distad produced in two rounded lobes separated by a deep apical cleft. Limbs rather short, wholly unarmed.

Generally straw-color. Antennae dark brown becoming paler distad. A broad post-ocular very dark brown band on head.

Length of body 45, length of head 2 8, width of head behind eyes 1.7, length of pronotum 2, length of mesonotum 11.8, length of metanotum including median segment 7.3, length of cephalic femur 12.3, length of caudal femur 12.9 mm.

Libethra reservata (Brunner)

Tequendama, Cundinamarca, 1925, (from A. Maria), 1 ♂.

This species is compared with *straminea* described above.

Libethra nisseri Stål

Vilacoberge (probably a Hacienda), Cauca, 2500 meters, I, 1909, 1 ♂, [Hebard Cln.].

Libethra metae new species (Pl. III, fig. 3)

Closely related to *molita* (Westwood) this species is easily distinguished by the male genitalia. In that species the seventh tergite expands strongly caudad and is decidedly shorter than the eighth, the poculum has a very decided lip and the eighth has its ventral margins folded back and a mammiform projection at its ventro-caudal angles.

Type.—♂; Villavicencio, Intendencia del Meta, Colombia. 1921. (From A. Maria.) [Hebard Collection, Type No. 1223.]

Size medium for the genus, form slender. Dorsal surface with tubercles entirely lacking, abdomen distad with lateral and a pair of median carinae briefly indicated in distal portions of tergites and seventh with a definite precurrent lateral carina on each side of a median carina. Seventh tergite distinctly longer than eighth and scarcely expanding caudad; eighth distinctly longer than ninth, its ventral margins simple, straight to the sharply rounded rectangulate ventro-caudal angle; ninth tergite moderately transverse, strongly inflated proximad on each side as is usual in the genus. Poculum moderately prominent, with a coarse node meso-ventrad; the distal lip moderately developed. Cerci short, stout, bent inward. Limbs simple, wholly unarmed.

Allotype.— ♀; same data as type but taken in 1921. [Hebard Collection.]

Size smaller, form decidedly heavier, limbs very much shorter. Dorsal surface thickly and finely but not sharply tuberculate, numerous weak longitudinal carinae indicated on abdomen. Ventral surface even more weakly tuberculate. Operculum elongate, projecting as far as ultimate tergite, very strongly carinate laterad in over proximal half, then with a medio-longitudinal carina only to the deep and narrow U-emargination between the narrow apices. Limbs with decided carinae, straight and unarmed.

Type brown with median femora greenish proximad. Paratypic male dark brown with cephalic and median limbs light green, the former particularly with brown suffusions, cephalic two-thirds of mesonotum deep green, head and metanotum proximad tinged with green. Allotype dark grayish brown.

The measurements of a paratype, bearing the same data, follow those of the type. Length of body ♂ 53.8 and 56, ♀ 45; length of mesonotum ♂ 15.4 and 15.7, ♀ 9.2; length of metanotum (including median segment) ♂ 10.7 and 10.9, ♀ 8 1; length of cephalic femur ♂ 15 8 and 17.3, ♀ 11.8; length of caudal femur ♂ 15.2 and 15.6, ♀ 10.8 mm.

Libethra rhabdota (Westwood)

Villavicencio, Intendencia del Meta, 1924, (from A. Maria), 1 ♀. Hacienda Pehlke, 1 ♀.

The last female has two strong tubercles instead of foliaceous lobes on the head, the lobes of the limbs all greatly reduced and confined to the inner carinae. This may indicate specific differentiation, but appears to be attributable rather to the decided individual variation to be expected in this and allied species.

Bacteria apolinari Hebard

Guaicaramo, Intendencia del Meta, 1924, (from A. Maria), 1 ♂. Paime, Cundinamarca, 1924, (from A. Maria), 1 ♀. Villavicencio, Intendencia del Meta, 1925, (from A. Maria), 1 very large juv. ♀.

These females agree closely with *B. significans* Redtenbacher, based on a female from "Bogotá," the head being strongly bicristate and the thorax very finely white speckled. They differ in having the proximo-ventral lobes of the median femora not denticulate and the seventh abdominal sternite produced distad in a pair of elongate irregular rounded large lamellae. Such features may be subject to great individual variation, and if that is the case *apolinari* will probably prove to be a synonym.

In the Villavicencio female the metatarsi are much more strongly rounded-triangularly lobate, the ventro-proximal lobes of the median femora are present on the external as well as on the internal margins and a long but low irregular lobation is present on the ventro-internal margin of the caudal femora proximad and is suggested on the ventro-external margin of that member.

ACRIDIDAE

ACRYDIINAE

Allotettix peruvianus (Bolivar)

Fusagasuga, Cundinamarca, XII, 1916, (from A. Maria), 1 ♂. Villavicencio, Intendencia del Meta, 1921, (from A. Maria), 1 ♀.

Paratettix frey-gessneri Bolivar

We have recently noted* that the two females from La Cumbre, Cordillera Occidental, Colombia, taken at 6600 feet, belonging to the Academy, are not *P. toltecus* (= *P. mexicanus* (Saussure)) as recorded by us in 1923 (Trans. Amer. Ent. Soc., XLIX, p. 169). They represent *frey-gessneri*, a species now known from as far north as Cuba, Jamaica and Tampico, Tamaulipas, Mexico. From these findings we believe that the Ecuadorean *P. borellii* Giglio-Tos 1897, which we had placed under *toltecus*, should be referred instead to synonymy under *frey-gessneri*.

EUMASTACINAE

Caenomastax insignis Hebard

Fusagasuga, Cundinamarca, 1920, (from A. Maria), 2 ♀.

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* Trans. Amer. Ent. Soc., LVIII, p. 225, (1931).

PROSCOPINAE

Proscopia aberrans Hebard

Muzo, Boyaca, 1925, (from A. Maria), 1 ♂, 1 ♀. Villavicencio, Intendencia del Meta, 1921, (from A. Maria), 2 ♂.

The previously unknown female is a little longer but very much more robust than the male. The moderately deflexed vertex is no longer but has its apex much broader, bluntly rounded. The pronotum, mesonotum and limbs are thickly tuberculate but none of the larger tubercles shown by the male are present.

Length of body 95, length of vertex 1.8, length of pronotum 23.1, least width of pronotum 3, length of caudal femur 35.2 mm.

ACRIDINAE

Amblytropidia insignis Hebard

Antioquia, Antioquia, XII, 21, 1930, (S. and C. H. Ballou), 2♂ (small for

Amblytropidia corrugata new species (Pl. III, fig. 4)

Two females, from Susumuco and Villavicencio, were recorded by us as *insignis* in 1923 at the time that species was described. A male from the latter locality now enables us to state that a distinct though very closely related insect is represented, its distribution confined to the eastern border of the Andes in Colombia. It is more widely distinct from *trinitatis* Bruner, a species occurring in eastern Venezuela and on the Island of Trinidad.

From *insignis* it differs mainly in the heavier build with broader vertex and shorter pronotum, the decidedly more rugose entire pronotal surface and less smooth occiput and pleura and generally darker coloration, with dark face and tibiae, the spines of the latter scarcely paler proximad than distad instead of being buffy with black tips.

Though geographic racial status may eventually be shown, there is no evidence as yet to indicate that.

Type.—♂; Villavicencio, Intendencia del Meta, Colombia. 1921. (From A. Maria.) [Hebard Collection, Type No. 1225.]

Size medium, form robust for the genus. Head with frontal costa broad (broader than in *insignis*[13]), coarsely impresso-punctate between the lateral margins, the impressions largest ventrad. Fastigium much as in *insignis* but slightly broader, lateral and median carinae equally prominent, occiput slightly roughened but supplementary carinae absent. Eye large but slightly smaller than in *insignis*. Antennae elongate, slightly shorter than caudal tibia. Pronotum with lateral lobes and disk strongly rugoso-impresso-punctate; disk distinctly shorter than in *insignis*, principal sulcus very weakly indicated there at base of caudal third, caudal margin moderately angulate produced; medio-longitudinal carina decided, lateral margins faintly divergent caudad, indicated by blunt angulation only. Organs of flight fully developed, very slightly surpassing apices of caudal femora. Distal portion of abdomen as in *insignis*. Caudal femora elongate and very robust proximad. Caudal tibiae with numerous (12) spines on dorso-external margin.

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[13] Distinctly narrower below the median ocellus in this specimen and the paratypic female only.

Allotype.—♀; same data as type but taken in May, 1917. [Hebard Collection.]

Much larger and more robust than male. Fastigium decidedly wider, distinctly wider than in this sex of *insignis*. Antennae proportionately decidedly shorter, as in female of that species. Pronotum even more strongly rugoso-impresso-punctulate than in male, with this only slightly less strongly present on pleura also. Organs of flight (as often in this sex of *insignis*) not quite reaching apices of caudal femora.

General coloration blackish chestnut brown, dorsal surface of male tegmina slightly paler and tinged with olivaceous. Eyes chestnut brown. Females with antennae paling inconspicuously proximad. Wings hyaline faintly tinged with pale blue-green, apices strongly suffused with bister. Dorsal surface of caudal femora buffy, but tinged with brown in females; sides and ventral surface garnet brown in male, sides blackish olivaceous and ventral surface maroon in females Caudal tibiae in male blackish with a purplish tinge, the spines only slightly darker distad than proximad; of female slightly paler, suffused deep mineral red with spines distinctly paler proximad than distad. Ventral surface and abdomen of male clay color, of female deep dull chestnut brown.

The measurements of a female paratype from Susumuco, Cundinamarca, follow those of the allotype. Length of body ♂ 21.2, ♀ 32 and 32.3; length of pronotum ♂ 4.3, ♀ 6.1 and 6.2; caudal width of pronotal disk[14] ♂ 2.9, ♀ 3.9 and 4.3; length of tegmen ♂ 18, ♀ 22 and 22.2; length of caudal femur ♂ 14.2, ♀ 18.3 and 19.6; width of caudal femur ♂ 3.2, ♀ 4 and 4.1 mm.

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[14] This is the dimension given as "width of pronotum" for *insignis*.

Cumarala annectens Hebard

Villavicencio, Intendencia del Meta, (from A. Maria), 1 ♂, 2 ♀ (♂ green dorsum, blackish sides, brown caudal femora; one ♀ brown with darker sides and well defined caudal femoral dark bars; one ♀ green dorsum, pronotal lateral lobes, pleura and caudal femora, elsewhere brown).

Orphulella concinnula (Walker)

Medellin, Antioquia, XII, 9, 1930, (C. H. Ballou), 7 ♂. Anolaima, Cundinamarca, IV, 1917, (from A. Maria), 1 ♀.

This is the species which in 1923 we recorded as the synonym *boucardi* (Bruner).

Orphulella punctata (DeGeer)

Antioquia, Antioquia, XII, 21, 1930, (S. and C. H. Ballou), 1 ♀. Anolaima, Cundinamarca, VII, 1916, (from A. Maria), 1 ♂. La Union, near Bogotá, Cundinamarca, I, 1913, (from A. Maria), 1 ♀. Honda, Tolima, VI, 1918, (from A. Maria), 1 ♂.

Peruvia nigromarginata (Scudder)

Villavicencio, Intendencia del Meta, 1921 and 1922, (from A. Maria), 5 ♂, 2 ♀.

Scyllina viatoria viatoria (Saussure)

Villavicencio, Intendencia del Meta, 1921, (from A. Maria), 1 ♀.

A decided tinge of bluish proximo-ventrad on the caudal femora shows a slight tendency toward *viatoria cyanomera* Hebard.

PAULININAE

Paulinia acuminata (DeGeer)

Tamalameque, Magdalena, I, 13, 1931, (C. H. Ballou), 13 ♂, 5 ♀. Maganguey, I, 14, 1931, (C. H. Ballou), 1 ♀.

CYRTACANTHACRINAE

Argiacris bivittata (Gerstaecker)

Villavicencio, Intendencia del Meta, 1919, 1920 and 1922, (from A. Maria), 6 ♂, 3 ♀.

Xyleus rosulentus (Stål)

Caudell has pointed out[15] that *Xyleus* Gistel has priority over *Diedronotus* Bolivar, names proposed for the preoccupied *Tropinotus* Serville.

Antioquia, Antioquia, X, 12, 1930, (S. and C. H. Ballou), 1 ♀.

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[15] Proc. U. S. Nat. Mus., LXXX, Art. 21, p. 3, (1932).

Tropidacris latreillei Perty

Villavicencio, Intendencia del Meta, (from A. Maria), 1 ♀.

Leptysma insularis (Bruner)

Villavicencio, Intendencia del Meta, 1920, (from A. Maria), 1 ♀.

Oxyblepta limbatipennis Stål

Muzo, Boyaca, 1920, (from A. Maria), 1 ♀. Villavicencio, Intendencia del Meta, 1925, (from A Maria), 1 ♂.

Copiocera austera Gerstaecker

Villavicencio, Intendencia del Meta, IV, 1920, (from A. Maria), 1 ♀.

This specimen closely resembles a female so recorded from the Madera River, Brazil. The abdominal tergites have large areas of ochraceous buff. The vertex is distinctly shorter than in the female type of *surinamensis* Rehn, a species agreeing in many respects but with pale abdominal areas orange chrome. Whether the shade of these areas is subject to individual variation in the species of *Copiocera* is not yet known.

Coscineuta coxalis (Serville)

Puerto Berrio, Antioquia, III, 23, 1930, (C H Ballou), 1 ♂, 5 ♀. Villavicencio, Intendencia del Meta, 1921, (from A Maria), 1 ♀

Ballou notes that the eyes in living material of this strikingly colored species are bright red.

Aristia mordax (Stål)

Santa Elena, Antioquia, I, 1, 1931, (Ballou and Archer), 1 ♂, 3 ♀.

The females are colored much as in *bicolor* Hebard and show the same very minute two pairs of elongate (longitudinally) tubercles on the pronotum near the median carina at its juncture with the cephalic margin (not mentioned by Stål).

The male shows a distinctive color phase with face and palpi buff yellow; fastigium, dorsal surface of head and pronotum and external pagina of caudal femora dull oil green; cephalic and median limbs lettuce green; genicular areas of caudal femora ferruginous; caudal tibiae scarlet red with spines black tipped; prosternum and cephalic margins of mesosternum blackish and ventral surface thence dull scarlet.

From *bicolor* the present insect is easily separated by the more produced ascendant and much more sharply rounded vertex, deeper head, pronotum slightly more strongly and sharply (but obtuse-angulate) produced caudad and much less reduced, overlapping tegmina.

Length of body ♂ 20.2, ♀ 25.7 (abdomen retracted) and 30.8; length of pronotum ♂ 5.4, ♀ 6 and 6.3; length of tegmen ♂ 7.8, ♀ 10.4 and 11.8; length of caudal femur ♂ 12, ♀ 15 and 15.6 mm.

Osmilia flavo-lineata (DeGeer)

Medellin, Antioquia, XII, 9, 1931, (C. H. Ballou), 1 ♀. Muzo, Boyaca, 1924, (from A. Maria), 1 ♂, 1 ♀. Fusagasuga, Cundinamarca, V, 1918, (from A. Maria), 1 ♂. Villavicencio, Intendencia del Meta, 1921 and 1924, (from A. Maria), 2 ♂, 2 ♀.

Oulenotacris hesperus Hebard

Villavicencio, Intendencia del Meta, 1921, (from A Maria), 1 ♀.

This may be considered the allotype and shows all the differences noted originally for the male when compared with the type female of *robusta* from Surinam, except that the pale oblique band from below eye to ventro-caudal angle of pronotum is equally conspicuous.

Antennae light brown, with two slightly paler annuli distad.

Length of body 22.2, length of pronotum 5, caudal width of pronotal disk 3.9, length of tegmen 12.3, length of caudal femur 12.9 mm.

Ommatolampis perspicillatus (Johannson)

Villavicencio, Intendencia del Meta, 1924, (from A. Maria), 1 ♀.

Schistocerca boyacae Hebard

Medellin, Antioquia, XII, 5, 1930, (Ballou and Archer), 1 ♀. Muzo, Boyaca, 1922, (from A Maria), 1 ♀.

This male allotype agrees closely with the type female except in being very much smaller with subocular line obsolete. Length of body 33, length of pronotum 6.3, caudal width of pronotal disk 3.9, length of tegmen 31.8, length of caudal femur 16.8 mm.

Trigonophymus punctulatus (Thunberg)

Guasca, Cundinamarca, I, 1913, (from A. Maria), 2 ♀.

Rhytidochrota brunneri Stål

Santa Elena, Antioquia, XII, 28, 1930, (S. and C. H. Ballou), 1 ♀.

This specimen is dark greenish brown, the antennae, palpi and ventral (including ventro-external) portion of caudal femora dull purplish pink.

TETTIGONIIDAE

PHANEROPTERINAE

Ceraia festae Giglio-Tos

Medina, Intendencia del Meta, 1931, (from A. Maria), 1 ♂.

A striking feature in this generally rich green insect are the antennae, proximad ochraceous tawny finely annulate with very dark brown, becoming solidly fuscous distad.

Described from Gualaquiza and the Valley of Santiago, Ecuador, a series from Chanchamayo, Peru, is in the Academy collection.

CERAIAELLA new genus

This genus, erected to include only the genotype, *triannulata* here described, is related to *Ceraia* Brunner. It differs in the small size of the species. Pronotum with prozona curving evenly into the lateral lobes with broadly convex lateral margins of disk converging cephalad and disappearing before cephalic margin. Tegmina comparatively narrow, with median vein strongly converging with ulnar vein and connected with it by a transverse vein at point of least separation, the median vein forking twice beyond that point. Caudal femora with ventral margins conspicuously lamellate with coarse widely spaced saw-tooth armament. Ovipositor with margins curving evenly distad, the ventral valves projecting briefly beyond the dorsal valves to an acute apex.

Known only from the female sex this genus shows the following additional characters. Vertex very small, slender, sulcate dorsad. Eyes prominent. Pronotum with lateral lobes much deeper than wide. Subgenital plate very small, triangular with apex rounded. Cephalic tibiae with foramina apert.

No affinity to *Parascudderia* Brunner exists, a genus nearer *Homotoicha* Brunner and its allies.

Ceraiaella triannulata new species (Pl III, fig 5)

The three dark brown annuli on the caudal tibiae are striking in this glossy, light green species.

Type.— ♀ ; Umbria, upper Putmayo River, Narino, Colombia. November 10, 1930. [Hebard Collection, Type No. 1226.]

Size small and form slender for the group. Vertex with dorsal surface weakly declivent, its cephalic face in contact with facial fastigium. Pronotum very smooth, a small impression mesad, margins moderately cingulate, humeral sinus rounded rectangulate. Tegmina and wings fully developed. Cephalic and median femora short and very robust. Caudal femora with inflated portion occupying proximal two-thirds. Femora with genicular areas of cephalic and median bluntly rounded with a minute spine ventrad, of caudal bispinose; ventral margins of cephalic and median unarmed except for a minute spine distad on one of the latter, external of these showing some lamellation, ventral margins of caudal femora with (5 and 6) external and (3 and 4) internal teeth and conspicuously lamellate. Ovipositor with dorsal margin to near base with very minute truncate teeth, present but even smaller at apex only of ventral margin; curvature of ventral margin even, dorsal margin bent upward proximad and forming a broadly rounded weakly obtuse angle.

General coloration light yellowish green (possibly yellowish due to discoloration). Antennae apparently unicolorous. Tegmina definitely glossy. Caudal femora dorsad with two light brownish areas and between them light colorless spots (probably delicately colored in life). Caudal tibiae with a striking dark brown annulus at two-thirds distance to apex, another half way from that point to apex and another at apex.

Length of body 14.3, length of pronotum 3.7, caudal width of pronotal disk 2.9, length of tegmen 25.2, greatest tegminal width 4.9, length of caudal femur 16.2, length of ovipositor 6.4 mm.

Euthyrrhachis consobrina Brunner

Villavicencio, Intendencia del Meta, 1931, (from A. Maria), 1 ♀.

Parableta integricauda Brunner

Villavicencio, Intendencia del Meta, V, 1919, (from A Maria), 2 ♀.

In one of these specimens the desiccated spots of the tegmina along the ulnar vein are blackish with veinlets whitish, in the other they are much more extensive, whitish with only a few blackish cells.

Steirodon validum Stål

Villavicencio, Intendencia del Meta, 1921, (from A. Maria), 2 ♂.

The tegmina toward the costal margin proximad show a broad and definite though delicate whitish suffusion.

Posidippus citrifolius (Linnaeus)

Villavicencio, Intendencia del Meta, 1913, (from A. Maria), 1 ♂.

The female recorded by Rehn in 1917 undoubtedly did not come from Bogotá proper but from some nearby lower and more tropical locality.

Steirodonopis bilobata Scudder

Villavicencio, Intendencia del Meta, IX, 1913, 1928 and 1931, (from A. Maria), 2 ♂, 2 ♀.

Anaulacomera sp. (Laticauda Group)

Anolaima, Cundinamarca, VII, 1916, (from A. Maria), 1 ♀.

This species differs from the female allotype of *invisa* (from Cundinamarca) only in the somewhat smaller size, proportionately smaller pronotum, narrower tegmina with veinlets not as closely woven giving a distinctly more delicately diaphanous appearance, the areolets along their sutural margin not darkened, more delicate limbs with femora apparently lacking pink dots and ovipositor very slightly longer and more slender.

Length of tegmen 23.4, greatest tegminal width 4.3, length of caudal femur 13.6, length of ovipositor 7.8 mm.

Though apparently a member of the Laticauda Group, sufficient characters are not shown by the female to warrant description until the opposite sex has been secured.

Anaulacomera sp. (Laticauda Group)

Villavicencio, Intendencia del Meta, 1924, (from A. Maria), 1 ♀.

This insect represents a species very close to if not the same as the preceding, differing only in the larger size, greater development of the organs of flight, tegmina with areolets along the sutural margin blackish brown and pink spots on pronotum and femora.

Length of tegmen 26.7, greatest tegminal width 4.8, length of caudal femur 14.3, length of ovipositor 8.2 mm.

Anaulacomera phaula Hebard

Muzo, Boyaca, VIII, 1915, (from A Maria), 1 ♀. Villavicencio, Intendencia del Meta, 1924, (from A. Maria), 1 ♀.

These specimens apparently represent *phaula*, based on a male from "Cundinamarca." Material from the same locality is needed to prove this definitely.

The present female agrees with the type very closely in ambisexual features. The limbs are longer than in the male, but this is apparently also true in *lanceolata* Brunner.

The ovipositor is distinctive and exactly as otherwise known only in females of *lanceolata* and this sex in the two species is very similar except for the larger size and heavier limb armament of *phaula*.

Length of tegmen 31.7, greatest tegminal width 5.9, length of caudal femur 19.1, length of ovipositor 8 mm.

Anaulacomera dentata Brunner

Villavicencio, Intendencia del Meta, (from A. Maria), 1 ♀.

This female is readily associated with the male recorded by us from the same locality in 1927, by its general similarity and slightly but definitely richer green coloration than is shown by the other species here considered. The previously unknown female has a spot of blackish brown in the caudal extremity of the anal field (this field being solidly that color in the male). Pink dots are few and only weakly indicated caudad on the pronotal disk and on the femora. The ovipositor is as in the species of the Laticauda Group.

Length of tegmen 26.2,[16] greatest tegminal width 5.3,[17] length of caudal femur 16.1, length of ovipositor 8.9 mm.

Anaulacomera lanceolata Brunner

Muzo, Boyaca, VII, 1923, (from A. Maria), 1 ♀.

We can not yet say whether or not our *apolinari* and *hirsuta* share with this species and our *phaula* the unusual type of ovipositor in which the margins are unarmed and the dorsal margin is distinctly concave just before the apex. If they do, separation of females not taken at the same time and place with males may well prove extremely difficult.

PROVIADANA new genus

This genus is erected to include a single species, *lita* here described, the genotype. Nearest affinity is shown to *Viadana* Walker in the acute vertex and tegmina with distal portion of ulnar vein, (normally unbranched) median vein and other branches of the discoidal vein running parallel and only moderately obliquely to the sutural margin.

The pronotum with lateral margins of disk rounding into the lateral lobes and elongate ovate tegmina (of normal form) are, instead, as in *Anaulacomera* Stål.

The cephalic and median tibiae are very finely sulcate and unarmed dorsad, but such a condition is now known to occur in species of both the above genera.

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[16] The tegminal length of our male is 26 mm., not 27 as given.

[17] The tegminal width of our male is 5.4 mm., not 6.4 as given.

Other generic characters are: Lamellate cephalic margin of vertex retreating so that at its juncture with the facial fastigium the latter projects farther. Eyes small, round, prominent. Pronotal disk deplanate, its margins very gradually divergent caudad; lateral lobes deeper than long, humeral sinus distinct. Organs of flight fully developed. Tegmina in median half widest, of almost equal width throughout. Mesosternum and metasternum bluntly bilobate. Ovipositor gradually curving to acute apex with margins finely serrulate. Subgenital plate (of female) small, truncate-triangular. Limbs not elongate; ventro-cephalic margins of femora armed with a few very small spines.

Proviadana lita new species (Pl III, fig 6)

This species may be readily recognized by the characters given above. We have awaited discovery of the male for some time to no avail, but feel that the genus and species are sufficiently distinctive and readily placeable to warrant description from the female alone.

Type.— ♀ ; Cundinamarca, Colombia. (From A. Maria.) [Hebard Collection, Type No. 1227.]

Size and form suggesting a large and rather broad-winged *Anaulacomera.* Fastigium slightly longer than its basal width, convex proximad on each side and there medio-longitudinally sulcate, narrowing sharply to the acute apex which does not project beyond the first antennal joint. Face without carinae or sulci. Pronotal disk smooth, with a very fine medio-longitudinal sulcus strongest caudad, caudal margin convex. Tegmina with network of veinlets very fine and regular; oblique branches of discoidal vein (including median vein) five in number, marginal field narrowing distad with veins to costal margin weak and directed distad moderately obliquely. Wings projecting moderately beyond tegmina. Ovipositor moderately elongate with portion of greatest depth slightly beyond the middle. Femora with blunt genicular lobes unarmed; femora with ventro-cephalic margins armed with minute teeth (cephalic 4 and 5, median 3 and 3, caudal 3 and 4[18]).

General coloration green, with no noteworthy markings.

The measurements of a female from Barro Colorado Island, Canal Zone, Panama, taken April 2, 1924, by J. C. Bradley, follow those of the type. Length of body 18 and 18.7, length of pronotum 4.3 and 4.7, caudal width of pronotal disk 2.6 and 2.8, length of tegmen 28 and 29, greatest tegminal width 7 and 7.3, length of caudal femur 14.8 and 15.7, length of ovipositor 8.2 and 9.7 mm.

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[18] In the Panamanian specimen the number of such teeth is slightly greater.

Viadana longicercata Brunner

Choachi, Cundinamarca, X, 1917, (from A. Maria), 1 ♀.

This specimen bears to Peruvian males of the species in the Academy collection the same contrast that females do to males of *myrtifolia* (Linnaeus) in the Philadelphia collections.

Length of tegmen 26.1, greatest tegminal width 10, length of caudal femur 13.9, length of ovipositor 8 mm.

BOLIVARITA new genus

This genus is erected to include, as genotype, *conjuncta* here described. The general form resembles *Phylloptera* Serville, but the tegmina narrow more evenly and strongly from proximal third to their apices. Their venation with ulnar vein bent suddenly toward the sutural margin, the unbranched median and (4 or 5) other branches of the discoidal vein running parallel, almost erect but curving caudad toward the sutural margin suggest instead *Proviadana* here described and *Viadana* Walker.

The absence of styles on the male subgenital plate and faintly sulcate ventral surface of the median femora (the only cephalic limb present is regenerated) show that much the closest affinity is indeed to the latter genera.

The present genus differs further from *Viadana* in the larger size, distinctive form, pronotum with lateral margins of disk rounding into the lateral lobes which are no deeper than wide, simple male cerci (except that in *V. foreli* the cerci are almost as simplified) and deeply cleft male subgenital plate.

Other generic characters are: Cephalic margin of vertex very slender dorsad but gradually widening ventrad, retreating so that at its juncture with the facial fastigium it is equally wide but the latter projects farther. Pronotal disk deplanate, its lateral margins very gradually divergent caudad. Organs of flight fully developed. Mesosternum decidedly bilobate, metasternum very broadly and less strongly bilobate. Limbs not elongate, delicate; ventro-cephalic margins of femora armed with a few very small but stout spines.

Bolivarita conjuncta new species (Plate III, figs. 7 and 8)

Though having a strongly *Phylloptera*-like appearance this insect is actually closely related to *Proviadana* and *Viadana.* It is indeed surprising to find *P. lita* and the present species, so widely distinct in general appearance, agreeing in so many features when analyzed. When both sexes of each are known, however, other striking features of difference will probably be found.

Type.—♂; Pensilvania, Caldas, Colombia. March, 1917. (From A. Maria.) [Hebard Collection, Type No. 1170.]

Size very large and form robust for the Group Viadanae. Fastigium nearly twice as long as its basal width, dorsad otherwise as here described for *Proviadana lita.* Face without carinae or sulci. Eyes small, round, prominent. Pronotal disk smooth, with a very fine medio-longitudinal carina broken by a moderate U-shaped sulcus and weak transverse lateral impressions indicated above the humeral sinus. Tegmina very broad, broadest beyond stridulating field, thence evenly and decidedly narrowing to apex; with a very fine and regular network of veinlets; oblique branches of discoidal vein (including median vein) six in number (but one forked on one tegmen); marginal field narrowing distad with veins to costal margin very weak and perpendicular. Wings moderately projecting beyond tegmina. Cerci curved evenly inward and gradually tapering to a blunt apical tooth. Subgenital plate with a large meso-distal V-emargination, a carina on each side running to each acute apex. Femora with blunt genicular lobes unarmed; teeth on ventro-cephalic margins of median 1, of caudal 3 and 3.

Length of body 19.4, length of pronotum 5, caudal width of pronotal disk, length of tegmen 33.8, greatest tegminal width 11.3, length of caudal femur 15 mm.

Phylloptera arata Brunner

Medina, Intendencia del Meta, 1931, (from A. Maria), 1 ♀. Villavicencio, Intendencia del Meta, IX, 1913, (from A. Maria), 1 ♂.

Microcentrum concisum Brunner

Colombia, (from A. Maria), 1 ♂

This is the first Colombian male we have studied. The pronotum is very finely but generally impresso-punctulate and this, the almost immaculate cephalic tibiae, with other slight but definite differences in the genitalia shows that the males recorded by us as this species from Panama and Nicaragua in 1927 represent an undescribed species and the male from Chiapas, Mexico in

1932 still another, both closely related and belonging to the Concisum Group but definitely distinct.

In *concisum* the cerci are elongate, weakly incurved, very slender distad with apex very slightly enlarged and bearing mesad a small tooth directed inward, as broad as long with ventral margin convex and dorsal margin straight to the dorso-distal subrectangulate apex. The subgenital plate is distad medio-longitudinally carinate and narrow, moderately produced disto-laterad to the style sockets so that the narrow distal margin is concave; the styles simple, straight, of moderate length, each slightly longer than the distance between their bases. Other males from the Santa Marta region to be studied later agree closely but show that variation occurs in the distal emargination of the subgenital plate and in the length of the styles.

Syntechna tarasca (Saussure)

Pensilvania, Caldas, VI, 1912, (from A. Maria), 1 ♂.

Syntechna olivaceoviridis Brunner

Choachi, Cundinamarca, (from A. Maria), 1 ♂.

PSEUDOPHYLLINAE

Scopiorus sutorius Stål

Santa Elena, Antioquia, XII, 28, 1930, (S. and C H. Ballou), 1 ♀.

The discovery of the female of this genotype is of particular interest. Unlike the Central American species referred to *Scopiorus*, the fastigium though slenderly produced slightly beyond the first antennal joint (when that is in an erect position) has the apex rounded and not acute. The pronotal disk has coarse irregular lateral carinae indicated, deeply cut by the two principal sulci, the caudal of which in this sex is situated very slightly caudad of the middle and mesad the disk shows a short deep cruciform impression. The moderately recurved ovipositor tapers to its acute apex, with none of the remarkable lateral specialization found in those species. The tegmina are very broad as in *brevifolius* Brunner but taper more strongly in distal half to the more acute apex. The tegminal veins form with their principal connecting veins more regular and conspicuous polygons in the discoidal field. The coloration in life was evidently light green.

Length of body 17, length of pronotum 4.3, length of tegmen 20.7, greatest tegminal width 8, length of caudal femur 12.8, length of ovipositor 7.7 mm.

Diacanthodis granosa Brunner

This diminutive species with metazona neither dilated nor spined may well prove to be generically distinct from the genotype, *Diacanthodis formidabilis* (Serville).

Umbria, upper Putmayo River, Narino, XI, 18, 1930, 1 ♀.

This specimen agrees closely with the unsatisfactory original description of the type, a male from Cayenne. The pronotum is covered with very irregular stout tubercles of varied size, a minute spine projects from a cluster of these mesad on the cephalic margin and a tubercle considerably longer but no larger than the others is present on this margin on each side of the disk; toward the very broadly convex caudal margin are many minute tubercles, but crenulation is not indicated. The tegmina show a number of very irregular nodiform elevations. The femora have the genicular lobes all sharply spined except the cephalic of the median femora and all terminate in a large weakly lamellate mesodorsal spine. The ovipositor is straight with dorsal margin serrulate and has two short lateral ridges running to that margin distad.

Length of body 23.8, length of pronotum 5.7, length of tegmen 27.7, greatest tegminal width 5.3, length of cephalic femur 7.4, length of caudal femur 13.9, length of ovipositor 13.7 mm.

Trichotettix pilosula Stål

Santa Elena, Antioquia, I, 1, 1931, (Archer and Aguilar), 1 ♀, [A.N.S.P.].

This specimen differs from the diagnoses[19] which have been given of the male type from Colombia[20] in being snuff brown with limbs and antennae marmorate with darker, the pronotum with cephalic margin showing a minute tooth suffused with blackish and flecks of blackish along its caudal margin and in having the ventro-cephalic margins of the cephalic femora armed.

The decided tegminal reduction of that male might well indicate that the female is apterous, as is the case with the present female. The small size, pilosity, bispinose prosternum, very short limbs and rectangulate ventro-caudal angles of the pronotal lateral lobes all agree with Stål's description. The face and genae are smooth, the pronotum with closely placed and large but very low nodes and coarse sulci. The cephalic limbs in this female show no thickening (which is said to be weakly indicated in the male and may be a feature peculiar to that sex). All of the femoral genicular lobes bear a large straight spine except the cephalic of the median femora; the ventro-cephalic femoral margins are armed with stout teeth (cephalic 3 and 3, median 3 and 3, caudal 5 and 5). The cephalic and median tibiae are unarmed dorsad. The ovipositor is short and deep, with ventral margin curving broadly to the acute apex, the dorsal margin very faintly convex and serrulate in distal half, the sides without specialization.

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[19] Brunner's diagnosis is in places evidently decidedly confused.

[20] Much of Stål's material from Colombia came from Antioquia.

Length of body 19, length of pronotum 3.8, length of cephalic femur 6, length of caudal femur 10.1, length of ovipositor 8.8, median depth of ovipositor 2.3 mm.

LIPAROSCELLA new genus

This genus is erected to include, as genotype, *Liparoscelis modesta* Brunner, described from "Colombia." The broadened flattened face separated on each side from the genae by a coarse vertical subocular carina and having its surface strongly coarsely and irregularly rugose and with vertical sulci, the unarmed dorso-external margins of the caudal tibiae and the highly specialized and distinctive male supra-anal plate and cerci distinguish it from *Liparoscelis* Stål, with which genus it agrees very generally otherwise. The species of these genera are very robust, with head proportionately larger and broader than in their allies.

Though the Mexican *Liparoscelis pallidispina* Stål also has the face rugose and the caudal tibiae without dorso-external spines, we believe that it represents that or still another new genus.

Liparoscella modesta (Brunner)

Colombia, (from A. Maria), 4 ♂, 7 ♀, 4 juv.

The previously unknown male is distinguished as follows. Tegmina shorter than pronotum. Ultimate tergite produced meso-distad in a small erect spine, below which are two subquadrate projections with dorsal surfaces deeply concave, their inner margins converging to the base of the spine. Cerci flattened, only slightly longer than wide, the apex broadly truncate and disto-ventral angle produced in a large incurved tooth. Subgenital plate produced, tapering, with small socketed styles briefly separated by an angulate emargination.

A male of medium size for the series measures: length of body 26, width of face 6.1, length of pronotum 6.8, exposed length of tegmen 5.8, length of cephalic femur 8, length of caudal femur 13.4 mm.

Chibchella femorata new species (Pl. III, fig. 9)

This insect agrees fully with our original diagnosis of the genus.[21] The simple male cerci and short truncate subgenital plate with very elongate styles surmounting short tubular elevations of its surface disto-laterad probably have also some generic significance.

From *C. personata* Hebard, known only from the female type (from Susumuco, Cundinamarca), the present male is distinguished by the shorter limbs, the median tibiae having the dorsal margins supplied with more numerous spines and the decidedly shorter caudal femora marked with a striking longitudinal black band near the ventral margin which extends from near the base to the pre-apical pale annulus. Other color differences are present, *femorata* being paler and decidedly more varied, but these might well be features of mere individual variation.

Type—♂; Villavicencio, Intendencia del Meta, Colombia. October, 1917. (From A. Maria.) [Hebard Collection, Type No. 1228.]

In addition to the features originally given in the generic description, the following are noteworthy. Size small and form normal when compared with species of *Cocconotus* Stål, but cephalic and median limbs more slender and auditory foramina more distinctly conchate. Distal margin of proximal antennal joint produced internally in a blunt spine, above which is a small tubercle on the second joint. Surface of pronotum irregularly rugulose rather than tuberculate, the cephalic margin with a trace of angulation and medio-longitudinal carina briefly indicated at caudal margin. Tegmina and wings briefly surpassing caudal femora. Supra-anal plate simple, deflexed, rounded triangular. Cerci of moderate length, gradually tapering and weakly incurved to apex which is surmounted by a tooth directed inward. Subgenital plate short, medio-longitudinally carinate, sides reflexed, apex transverse, a short tubular projection latero-distad with apex forming the socket for the styles. Styles simple, very slightly recurved, slightly longer than subgenital plate and separated by a distance fully three-quarters the length of one of them. Median tibiae armed dorsad with (2 and 1) external and (6 and 6) internal spines. All genicular lobes spined, these spines incurved except the internal of the median femora which are straight.

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[21] Trans. Amer. Ent. Soc., LII, p. 317, (1927).

Genae and sides buffy with a greenish tint; abdomen buffy suffused with brown distad. Face ecru olive, a median dorsal dot, a pair of short lines mesad and two more widely separated linear flecks and a median spot of buff above the pale mouthparts, the mandibles brown dorso-internally. Antennae finely marked with light and dark brown and buff. Fastigium and occiput mesad dark brown. Pronotal disk brown marked with buff caudad. Tegmina brown with veinlets buffy; stridulating field darker with stridulating vein very dark but area preceding it buffy. Femora buffy flecked with brown (particularly on caudal femora), becoming darker to a clear buff apical annulus with apical portion blackish brown; caudal femora with a conspicuous blackish brown band as described above, spines buff with apices russet; tibiae buffy marked with brown and with spines russet.

Length of body 24.3, length of pronotum 6.2, caudal width of pronotal disk 4.2, length of tegmen 26.2, greatest tegminal width 5.8, length of cephalic femur 9.9, length of caudal femur 18.8, length of style 3.4 mm.

Cocconotus innotatus (Walker)

Fusagasuga, Cundinamarca, 1919, (from A. Maria), 1 juv. ♂.

This is apparently the most abundant species of the genus in eastern Cundinamarca at elevations of from 3000 to 5000 feet.

Cocconotus retiarius Stål

Muzo, Boyaca, 1923, (from A. Maria), 1 ♂.

This specimen has the proximal antennal joint bearing a stout blunt dorso-internal spine. The internal genicular lobes of the median and caudal femora bear a small curved spine. The ventro-external margins of the caudal femora bear 6 and 7 spines (5 in the type). The cerci are extremely elongate, bi-sinuate proximad, then feebly incurved, with apex produced in a straight dorsal lamella with extremity truncate and with two minute teeth, at the base of which produced ventrad is a sharply incurved tooth with a smaller tooth adjacent to its base proximad. The subgenital plate is strongly produced with narrow apex narrowly emarginate one-third the length of the plate between the very elongate styles (which are over twice as long as the emargination).

Length of body 31, length of pronotum 7, caudal width of pronotal disk 3.7, length of tegmen 35.2, greatest tegminal width 8, length of cephalic femur 10.8, length of caudal femur 21.8 mm.

Cocconotus aratifrons Brunner

Muzo, Boyaca, V, 1919, (from A. Maria), 2 ♂.

These males show that *C. vittagenae* Bruner is indeed closely related,[22] apparently differing only in the larger size and much longer supra-anal plate. This plate in the present specimens is concave dorsad, with lateral margins straight convergent to the flattened bi-nodose apex, and is no longer than its basal width. In *vittagenae* its margins are concave-convergent, then parallel in distal third to the larger though similar apex, it is one-third longer than its basal width and dorsally transversely concave to the apex.

The present males are smaller than Brunner's male, measuring: length of body 26.4 and 29, length of tegmen 31.5 and 32.8, length of caudal femur (missing) and 18.8 mm.

Rhodopteryx hebardi Vignon

1930. *Rhodopteryx hebardi* Vignon, Archiv. Mus. Nat. d'Hist. Nat., Paris, (6), v, p. 113. [♂ type (figured by Hebard in 1927), Muzo, Boyaca, Colombia. (Hebard Collection, Type No. 1203.)]

Muzo, Boyaca, 1922 and 1924, (from A. Maria), 2 ♀.

There is no doubt as to the correct association of the sexes of the six specimens, two males and four females, now before us from Muzo. It is a remarkable fact that in this species the tegmina of the males have the meso-distal concavity of the costal margin moderately decided and the distal portion of the sutural margin deeply trisinuate, although they have in females the former weak and the latter entirely absent. Such would not be expected from the fact that in the closely related *R. elongata* Vignon 1924[23] both sexes are similar and like the female of *hebardi*.

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[22] See Hebard, Trans Amer. Ent Soc., LII, p. 327, (1927).

[23] Now known from a female from Darien (type), a male from Cundinamarca, Colombia. The variety *crocea* Vignon 1927 of *Rhodopteryx elongata*, based on a pair from Buena Vista, Magdalena, Colombia, apparently represents merely a recessive color phase of that species, unworthy of nominal recognition.

Typophyllum pererosum new species (Pl. III, figs. 10 and 11)

This species is nearest the Peruvian *T. acutum* Vignon.[24] It agrees in form, the thickly granulate pronotum with caudal margin of disk rounded obtuse-angulate produced, tegminal contour (except distal margin of anterior field, quadridentate), ventro-cephalic margins of cephalic and median femora, strongly enlarged proximal portion of median tibiae, abdomen with 2d, 3d and 7th tergites showing lamellate productions and highly specialized ovipositor.

It differs in the slightly more sulcate fastigium (which falls considerably short of the plane of the face and is pressed down between the elevated margins of the antennal sockets), tegmina with distal portion of costal margin conspicuously eroded and desiccated spots more numerous, wings with veins and cross veinlets brown, this very faint except distad in the anterior field and the much more nearly simple (not strikingly lamellate) cephalic and median femora with triangular spines smaller and less lamellate.

Type.—♀; Muzo, Boyaca, Colombia. 1922. (From A. Maria.) [Hebard Collection, Type No. 1109.]

Size rather small (considerably smaller than the type, slightly smaller than our specimen of *acutum*). Axis of tegmen straight.[25] Cephalic tibiae with margins of auditory foramina not nearly reaching as far as dorsal surface of limb.[26] Caudal limbs missing (probably dilated proximad as in allied species). Tegmina with anterior field strongly dilated meso-distad, sutural margin decidedly eroded meso-distad.

The species of this group undoubtedly vary considerably and association of the sexes is extremely difficult. Vignon has made a great advance. We only regret that other characters, clearly of great value in separating these difficult species, have not been given as complete consideration as have those found in the tegmina and wings, particularly the contour, venation and desiccation of the latter.

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[24] A female of *acutum* from Chanchamayo, Peru, is in the Academy collection; very similar but considerably smaller than the female type from Pozuzo, Peru. Caudell's *T. undulatum* is clearly another related species, nearer *acutum*.

[25] This and the following characters are given in the order of Vignon's key, Archiv. Mus. Nat. d'Hist. Nat., Paris, (6), v, p. 116, (1930).

[26] In our specimen of *acutum* these margins on the cephalic face are produced as far as the dorsal surface of the limb, on the caudal face projecting slightly beyond that point.

Generally mummy brown with faint marbling of prouts brown, the tegminal spots opaque buffy in most cases with brown flecks. Wings whitish, veins buffy becoming brown distad in anterior field, the exceedingly fine veinlets elsewhere light pinkish brown. Tegmina with costal margin showing feeble concavity of each marginal cell in dilated portion, beyond that with sections margining cells E, F and G strongly concave; with sutural margin showing a small deep erosion at apex of vein between cells U‴ and T and another broader but no deeper erosion at apex of the following vein (between cells T and S); apices of tegmina produced (damaged but apparently much as in *acutum*). Tegmina with desiccated spots as follows: a large one (t_1) in ventro-cephalic angle of cell T, next largest (d_1) meso-proximad in cell D, smaller one in each of cell U, meso-distad in cell D, mesad in the next marginal cell; two small vitreous areas, one in cell T meso-distad (t_2) and one in cell S mesad. The spot t_1 is opaque in all but its narrow hyaline margins. Abdomen with first tergite showing a trace of meso-distal lamellation, second tergite with a moderate meso-distal lamellation, third tergite with a decided meso-distal lamellation, seventh tergite with a still larger moderately irregular lamellation. Ovipositor recurved, shaft with well spaced minute dorsal teeth; apex moderately thickened, thickly supplied with short stout teeth.

Length of body 18.5, length of pronotum 5.3, caudal width of pronotal disk 4.1, length of tegmen (estimated, apex missing) 29.5, greatest (subapical) tegminal width 17.4, greatest width of anterior field of tegmen (subapical) 9.2, greatest width of posterior field of tegmen (mesad) 8.1, length of wing 22, length of ovipositor 9.1 mm.

Typophyllum lunatum Pictet

Villavicencio, Intendencia del Meta, (from A. Maria), 1 ♀.

This specimen agrees closely with a female from Macas, Ecuador, in the Academy collection, but has the tegmina slightly more ample. Length of tegmen 39.2, greatest width of tegmen 28.5 mm.

COPIPHORINAE

Neoconocephalus triops (Linnaeus)

Medellin, Antioquia, XII, 14, 1930, (S. and C H. Ballou), 1 ♀ (green). Muzo, Boyaca, 1921, (from A. Maria), 1 ♀ (brown).

Neoconocephalus affinis affinis (Beauvois)

Muzo, Boyaca, II, 1919, (from A. Maria), 3 ♂, 2 ♀ (all green except one brown male). Choachi, Cundinamarca, IX, 1918, (from A. Maria), 1 ♀ (green). Fusugasuga, Cundinamarca, II, 1919, (from A. Maria), 1 ♀ (green). Villavicencio, Intendencia del Meta, II, 1919 and 1921, 3 ♂, 1 ♀ (two males green, pair brown).

Neoconocephalus maxillosus (Fabricius)

Medellin, Antioquia, XI, 24 and XII, 10, 1930, (C. H. Ballou), 2 ♀ (green). Muzo, Boyaca, 1918, (from A. Maria), 2 ♀ (green). Aguadita, Cundinamarca, V, 1915, (from A. Maria), 1 ♂ (green). Villavicencio, Intendencia del Meta, 1918 and 1927, (from A. Maria), 1 ♂, 3 ♀ (all green except one brown female).

Copiphora cornuta denticornis Hebard

Villavicencio, Intendencia del Meta, (from A. Maria), 1 ♀.

Moncheca pretiosa Walker

Cordillera Central, Caldas, XI, 1917, (from A. Maria), 1 ♀ (recessive coloration).

Vestria viridis (Redtenbacher)

Villavicencio, Intendencia del Meta, (from A. Maria), 1 ♀.

This specimen agrees closely with material before us from San Esteban, Venezuela; Caparo, Trinidad, and Obidos, Brazil. The species' distribution, like that of *V. repanda*, evidently extends from the Atlantic to the eastern foothills of the Andes in northern South America.

CONOCEPHALINAE

Conocephalus cinereus (Thunberg)

Puerto Berrio, Antioquia, I, 11, 1931, (C. H. Ballou), 1 ♂, 1 ♀ (macropterous).

Conocephalus angustifrons (Redtenbacher)

Medellin, Antioquia, XII, 9, 1930, (C. H. Ballou), 2 ♂, 1 ♀ (small, brachypterous).

Conocephalus saltator (Saussure)

Medellin, Antioquia, XII, 9, 1930, (C. H. Ballou), 2 ♂, 4 ♀ (small, brachypterous).

LISTROSCELINAE

Phlugis teres (DeGeer)

Antioquia, Antioquia, XII, 21, 1930, (S. and C. H. Ballou), 1 ♀.

Phlugis chelifera Rehn

Nearest in relationship to *P. abnormis* Redtenbacher, this interesting species is quickly distinguished by the very different specialization of the male genitalia, this particularly prominent in the ultimate tergite.

Villavicencio, Intendencia del Meta, X, 1918, (from A. Maria), 1 ♂.

The present record extends the known range of the species from the Atlantic coast to the eastern foothills of the Andes in northern South America.

GRYLLIDAE

NEMOBIINAE

Nemobius brasiliensis (Walker)

Tamalameque, Magdalena, I, 13, 1931, (C. H. Ballou), 2 ♂, 2 ♀ (caudate, coloration intensive).

OECANTHINAE

Neoxabea trinodosa Hebard

San Antonio, Cauca, 2 ♂ topotypes, [Hebard Cln.].

Neoxabea meridionalis Bruner

1916. *Neoxabea meridionalis* Bruner, Ann. Carnegie Mus., x, p. 400. [♂, ♀; Valparaiso, Magdalena, Colombia at 4500 feet.]

1928. *Neoxabea intricata* Hebard, Trans. Amer. Ent. Soc., LIV, p. 99, pl. XV, fig. 3. [♂ and juv.; Summit of Sierra San Lorenzo at 8500 feet, and Hacienda Vista Nieve at 5000 feet, Magdalena, Colombia.]

The type series of *meridionalis*, most kindly loaned to us by the Carnegie Museum, proves the above synonymy.

Bruner's comments on the tegminal blotches in his key distinguish the female only of *bipunctata* from the present species. He further described the male abdominal specialization inexactly; it is, in the male type (here selected) of *meridionalis* belonging to the Carnegie Museum, as described and figured by us in 1928. The only variation shown in the four paratypic males is that in one of them the fourth tergite also shows a weak but distinct pair of convexities homologous to the nodes of the fifth and sixth tergites.

TRIGONIDIINAE

Anaxipha pulicaria (Burmeister)

Magdalena River below Puerto Berrio, I, 11, 1931, (C. H. Ballou; on steamer), 2 ♂, 2 ♀ (macropterous). Puerto Wilches, Santander, I, 12, 1931, (C. H. Ballou), 4 ♀ (macropterous). Medellin, Antioquia, XII, 10, 1930, (C. H. Ballou), 2 ♂, 1 ♀ (brachypterous), 4 juv. Antioquia, Antioquia, XII, 21, 1930, (C. H. Ballou), 1 ♀ (small, brachypterous).

ENEOPTERINAE

Eneoptera surinamensis (DeGeer)

Medina, Intendencia del Meta, (from A. Maria), 2 ♂.

Aphonomorphus timidus (Saussure)

Muzo, Boyaca, 1922, (from A Maria), 1 ♀.

This female agrees even more fully with the unsatisfactory original description of *timidus* than does the female from Pensilvania, Cundinamarca, recorded by us under the misspelling "*tumidus*," in having the antennae finely annulate and the oblique tegminal bands finely but more distinctly indicated. The cephalic and median limbs are similarly dotted with dark brown, but such is much more definitely indicated on the caudal femora in the present specimen, particularly on the ventral margin distad. This individual is also slightly more robust and the ovipositor is shorter.

Though the Pensilvania specimen may represent a closely related but distinct species, these differences may easily be attributable to nothing more than considerable individual variation.

Length of body 19, length of pronotum 3.9, length of tegmen 22.7, exposed length of wing 5.8, length of caudal femur 15.5, width of caudal femur 3.9, length of ovipositor 16.5 mm.

MOGOPLISTINAE

Cycloptiloides americanus (Saussure)

Medellin, Antioquia, XII, 5, 1930, (Ballou and Archer; in school, in clothes closets and other dark places doing considerable damage), 6 ♂, 3 ♀, 6 juv.

Previously recorded from Cuba, Mexico, Venezuela and Hawaii, the knowledge that *americanus* is a domiciliary pest indicates that the species has been so widely distributed by commerce. It may indeed be of African origin.

TRIDACTYLINAE

Tridactylus minutus strigatus new subspecies (Pl. III, fig. 12)

This insect averages smaller and more slender, with markings less strongly contrasted and more longitudinally strigate than typical *minutus* Scudder. The general similarity and material from the Santa Marta region of Magdalena which shows convergence toward *minutus minutus* (where specimens typical of that race were also secured) lead us to believe that no more than a geographic race is represented.

Detailed study of our material indicates that though *minutus minutus* reaches as far south as the Santa Marta region of Colombia, all other South American specimens represent other entities.

The female from Pará, Brazil, recorded by Rehn as *minutus* and so placed by us in 1928, has similar genitalia but vague cephalic markings suggesting *wagneri* Chopard and may be a color phase, a race or a close relative of that species.

Argentinian material mentioned by us as possibly *minutus* in 1928 is very similar to the typical race of that species in marking, but a female now at hand shows that a species, very distinct genitalically, is represented. We have also examined females of another species from Peru with distinctive genitalia.

Type.— ♀; Tamalameque, Magdalena, Colombia. January 13, 1931. (C. H. Ballou.) [Acad. Nat. Sci. Phila., Type No. 5519.]

Size very small and form very slender. Interocular space as in typical *minutus* faintly more than length of an eye. Pronotum with merest trace of a transverse sulcus meso-cephalad in median portion only. Organs of flight fully developed. Cephalic tibiae spatulate, their external surfaces weakly convex, armed distad with minute claws. Genitalia as in *minutus*, with subgenital plate showing weak concavity of the converging sides before the convex apex; the cleft plate beneath well projecting beyond it.

Allotype.—♂; Bearing the same data agrees closely except that the subgenital plate is subquadrate with sides narrowly reflexed, their margins rounding into the transverse apex.

General coloration buffy. Head with occiput at caudal margin with a quadrate median mark and on each side a larger triangular spot of dark brown, interocular area with two pairs of vague oblique suffusions, face largely dark brown. Pronotum with numerous brown markings homologous to those of typical *minutus* but less decided and less extensive than the normal in that race. Tegmina with anal field brown with a longitudinal buffy spot, elsewhere buffy but dark brown at veins and near costal margin (thus having a longitudinally striped appearance) and apices dark brown (with no trace of the large buffy spot present meso-distad on the tegmina of typical *minutus*[27]). Limbs marked with brown as in typical *minutus* except that the markings are less extensive than is usual in that race and almost all are more longitudinal.

The longitudinally striped appearance is quite different from that of *minutus minutus*, in which race wide diversity between the most recessive and most intensive color phases exists, but a dotted or transversely barred appearance always results.

Specimens Examined: 10; 6 males and 4 females.

Tamalameque, Magdalena, I, 13, 1931, (C. H. Ballou), 3 ♂, 4 ♀, *type, allotype, paratypes*. Aracataca, Magdalena, VII, 5 and 13, 1920, (M. Hebard; at light), 3 ♂ (slightly to decidedly divergent toward typical *minutus*). Tucurinca, Magdalena, VII, 7, 1920, (M. Hebard; on bare sand beside Tucurinca River), 1 ♂ (decidedly divergent toward typical *minutus*).

RIPIPTERYGINAE

Ripipteryx pulicaria Saussure

Tamalameque, Magdalena, I, 13, 1931, (C. H. Ballou), 1 ♂. Antioquia, Antioquia, XII, 21, 1930, (C. H. Ballou), 4 ♂, 14 ♀, 1 juv.

These specimens have the antennae dark, with dorsal surfaces of joints sometimes buffy and the three last joints buffy or the terminal joint distad or in large part darkened.

EXPLANATION OF PLATES

PLATE II

Fig. 1.—*Chorisoneura apolinari* new species. Cephalic view of head to show interocular marking. Female. *Type*. Fusagasuga, Cundinamarca. (Greatly enlarged.)

Fig. 2.—*Chorisoneura apolinari* new species. Dorsal view of pronotum. Female. *Type*. Fusagasuga, Cundinamarca. (× 17)

Fig. 3.—*Pseudomops boyacae* new species. Dorsal view. Male. *Type*. Muzo, Boyaca. (× 3)

Fig. 4.—*Pseudomops boyacae* new species. Ventral view of male subgenital plate. *Type*. Muzo, Boyaca. (Greatly enlarged.)

Fig. 5.—*Lauxoblatta frater* new species. Dorsal view. Male. *Type*. Antioquia. (× 2)

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[27] In rare recessive individuals of that race, however, the tegmina are entirely buff to their brown apices.

Fig. 6.—*Hypercompsa xanthosticta* new species. Dorsal view. Female. *Type.* Medellin, Antioquia. (× 5)

Fig. 7.—*Antioquita punctigera* new species. Dorsal view. Male. *Type.* Antioquia. (× 3)

Fig. 8.—*Brachyelena hirsuta* new species. Dorsal view of dextral tegmen. Female. *Type.* Santa Elena, Antioquia. (× 3½)

Fig. 9.—*Pseudophasma flavidum* new species. Dorsal view of dextral tegmen. Male. *Allotype.* Guaicaramo, Intendencia del Meta. (× 3½)

Fig. 10.—*Isagoras apolinari* new species. Lateral view of distal portion of male abdomen. *Type.* Muzo, Boyaca. (× 6½)

Fig. 11.—*Isagoras apolinari* new species. Ventral view of male subgenital plate. *Type.* Muzo, Boyaca. (× 6½)

Fig. 12.—*Isagoras ecuadoricus* new species. Ventral view of male subgenital plate. *Type.* Paramba, Imbabura, Ecuador. (× 6½)

Fig. 13.—*Isagoras chopardi* new species. Lateral view of distal portion of male abdomen. *Type.* St. Laurent du Maroni, French Guiana. (× 6½)

PLATE III

Fig. 1.—*Tribonium colombicum* new species. Dorsal view. Male. *Type.* "New Granada." (× 3)

Fig. 2.—*Libethra straminea* new species. Dorsal view of distal portion of male abdomen. *Type.* Bogota, Cundinamarca. (Much enlarged.)

Fig. 3.—*Libethra metae* new species. Dorsal view of distal portion of male abdomen. *Type.* Villavicencio, Intendencia del Meta. (Same scale as Fig. 3.)

Fig. 4.—*Amblytropidia corrugata* new species. Dorsal view of head and pronotum Male. *Type.* Villavicencio, Intendencia del Meta. (× 5)

Fig. 5.—*Ceraiaella triannulata* new species. Lateral view. Female. *Type.* Umbria, Narino (× 2)

Fig. 6.—*Proviadana lita* new species. Lateral outline of tegmen showing principal veins. Female. *Type.* Cundinamarca. (× 2)

Fig. 7.—*Bolivarita conjuncta* new species. Lateral outline of tegmen showing principal veins. Male. *Type.* Pensilvania, Caldas (× 2)

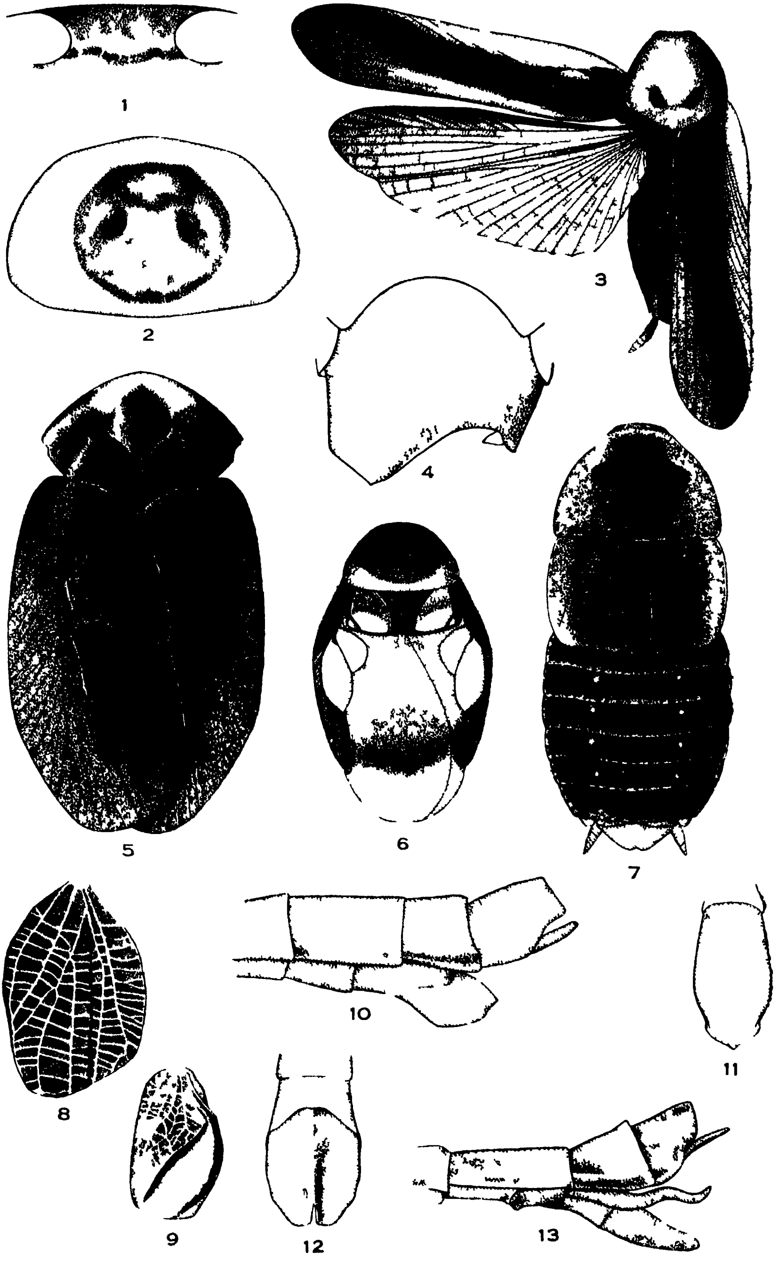
Fig. 8.—*Bolivarita conjuncta* new species. Caudal view of apex of male subgenital plate. *Type.* Pensilvania, Caldas. (Greatly enlarged.)

Fig. 9.—*Chibchella femorata* new species. Lateral view of caudal femur. Male. *Type.* Villavicencio, Intendencia del Meta. (× 3)

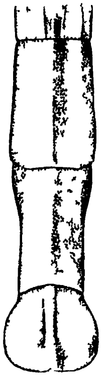
Fig. 10.—*Typophyllum pererosum* new species. Outline of cephalic face of cephalic femur. Female. *Type.* Muzo, Boyaca. (× 7½)

Fig. 11.—*Typophyllum pererosum* new species. Lateral view of tegmen showing principal veins and eroded areas. Female. *Type.* Muzo, Boyaca. (× 1½)

Fig. 12.—*Tridactylus minutus strigatus* new subspecies. Dorsal view of head, pronotum, tegmina and part of wings. Female. *Type.* Tamalameque, Magdalena. (× 13)



HEBARD—COLOMBIAN DERMAPTERA AND ORTHOPTERA



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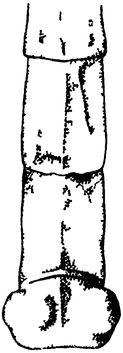

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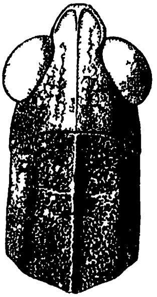

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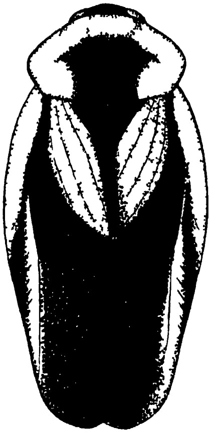

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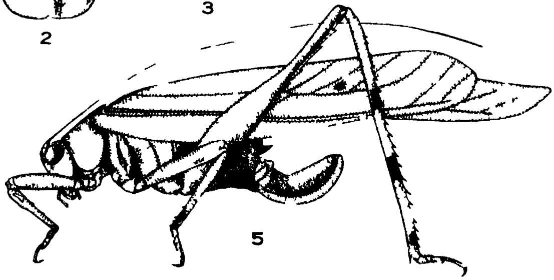

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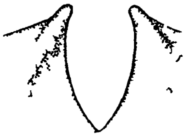

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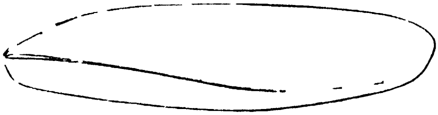

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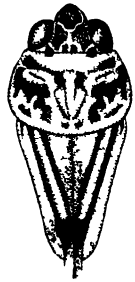

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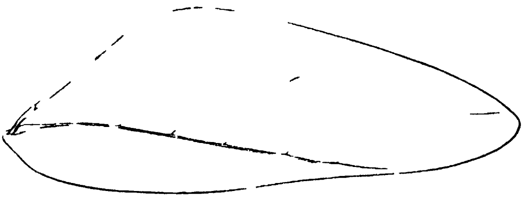

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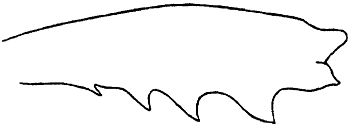

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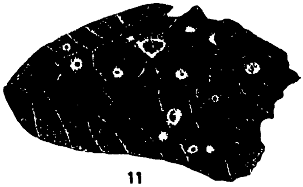

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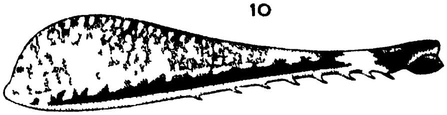

9

HEBARD—COLOMBIAN DERMAPTERA AND ORTHOPTERA

STUDIES IN THE AMERICAN HESPERIOIDEA

PAPER I

(LEPIDOPTERA)

BY ROSWELL C. WILLIAMS, JR. AND ERNEST L. BELL

(Plate IV)

SOME NOTES ON GENERA

PROTEIDES Hubner

1820. *Proteides* Hubner, Verz. Bek. Schm., p. 104.
1820. *Epargyreus* Hubner, Verz. Bek. Schm., p. 105.

In his *Proteides*, distinguished from *Goniurus* by their short, instead of long tails, Hubner listed eight miscellaneous insects, of which the first mentioned, *mercurius* Cramer, was cited as the type by Butler.

Epargyreus, distinguished from *Proteides* by the lower wings below being banded with silver spots, of which the second named, *tityrus* Fabricius (*clarus* Cramer) was cited as the type by Scudder. The first now includes the single species *mercurius* and its several Insular races, while the second includes a number of species with and without the silver bands. Godman and Salvin in the Biologia separated the two genera on the absence of the costal fold in the male in *Proteides*, a difference in the male genitalia, and some minor characters.

It is now generally agreed that the presence or absence of a secondary sexual character is not in itself a generic distinction. As to the genitalia, the uncus, saccus, and aedoeagus are practically alike in the two genera, the difference being in the clasps, which do not differ in structure, but only in shape to the extent that might be expected between species in any genus, and no greater than obtains in the several species included in *Epargyreus*. We therefore believe the species should be assembled under *Proteides*, the first name used by Hubner.

ACHLYODES Hubner

1820. *Achlyodes* Hubner, Verz. Bek. Schm., p. 107.
1836. *Eantis* Boisduval, Spec. Gen., pl. 13, fig. 6.

Hubner included in his genus, *busirus* Cramer (*busiris*), *thraso* Hubner and *fridericus*. *Busirus* was cited as the type by Butler. *Eantis* of course was based, without description, on *thraso*. Godman and Salvin in the Biologia, though pointing out differences between *busirus* and *thraso*, united them in the genus *Eantis*. They used *Achlyodes* for *fridericus* and others, due to a false restriction, but this has since been replaced by *Ouleus* Lindsey.

Other American species not included in the Biologia or since described seem to connect the rather extreme *busirus* and *thraso* and we therefore believe that *Eantis* should fall to the earlier genus.

CAMPTOPLEURA Mabille

1877. *Camptopleura* Mabille, Petit Nouv. Ent., II, p. 166.
1903. *Cycloglypha* Mabille, Gen. Ins , XVII, p. 70.

Theramenes was described and indicated as the type of *Camptopleura* though *thrasibulus* Fabricius was referred to as being congeneric. Later Mabille erected the genus *Cycloglypha* evidently for *thrasibulus* as it is particularly referred to in the differentiation between the two genera. Godman and Salvin placed both species in *Camptopleura*.

The difference mentioned by Mabille is in the shape of the lower wing. The slightly angulated appearance of the lower wing is evident in a greater or less degree in species now included in both genera, as well as in the types of each, and as we can find no other structural differences to warrant separation, we believe *Cycloglypha* should fall to the earlier described genus.

TELEGONUS Hubner

1920. *Telegonus* Hubner, Verz. Bek. Schm., p. 104.
1920. *Astraptes* Hubner, Verz. Bek. Schm., p. 103.

The type of *Telegonus* was cited as *talus* Cramer by Butler, that of *Astraptes* as *aulestes* Cramer by Scudder. These two species are now considered to be congeneric, but as both genera were erected by the same author, and as *Astraptes* has only page priority over *Telegonus*, and the latter name has been used so generally and for such a long time to the exclusion of the former, we believe that for the sake of stability *Telegonus* should continue to be used.

ON THE SYNONYMY OF SOME SPECIES

Telegonus jariba (Butler)

1870. *Aethilla jariba* Butler, Trans Ent. Soc. London, 1870, p. 496. [Cuba.]
1872. *Aethilla jariba* Butler, Lep Exot , p. 111, pl 40, fig. 3.
1916 *Telegonus geronae* Holland, Ann. Carnegie Mus., x, p. 503. [Isle of Pines, Cuba.]

race **jaira** Butler

1870. *Aethilla jaira* Butler, Trans. Ent. Soc. London, 1870, p. 496. [West Indies]
1872. *Aethilla jaira* Butler, Lep. Exot., p. 110, pl. 40, fig. 11.
1927. *Telegonus jariba* race *jamaicensis* Williams, Trans. Amer. Ent. Soc., LIII, p. 282, pl 24, fig. 3, and fig 25 (♂ genitalia). [Cuna Cuna Pass, Jamaica]

Some additional specimens of *jariba* from Loma del Gato, Cuba, received from Dr. Levi Mengel of Reading, Pa. and in the Collection of the Academy in Philadelphia, has lead us to a further study of this species with the result that we consider *jaira* to be a Jamaican race of *jariba*. The Cuban species is very dark, almost black, the fringes are the same color, the hairs on the body above are dark blue-green, and this tint on the wings is confined to the basal portion. The Jamaican race is lighter in color, of a soft deep brown, the fringes are lighter, and there is the indication of a lighter shade above the inner margin of the primaries below.

The metallic suffusion is green rather than blue-green and covers a larger area on the basal portion of the secondaries above.

The names *vespasius* Fabricius, "in Indis," and *cassander* Fabricius (no locality given), have been used for the Cuban species, but there is no mention in the descriptions of the green body and shading which could hardly be omitted by the author. *Jaira* Draudt, in Seitz, Macrolep, V, placed as a form of *creteus* Cramer, and figured, Pl. 167d (no locality given) is not *jaira* Butler.

Goniurus proteus (Linneus) form **viterboana** Ehrmann

1907. *Thymele viterboana* Ehrmann, Can. Ent., xxxix, p. 312. [Socorro, Colombia.]

1926. *Eudamus huancavillcas* Williams, Trans. Amer. Ent. Soc., lii, p. 72, pl. 3, fig. 3, and fig. 14 (♂ genitalia). [Huigra, Ecuador]

1927. *Thymele viterboana* Holland, Ann. Carnegie Mus., xvii, p. 346, pl. 28, fig. 11 (type). "A variety or aberration of proteus."

Both names, *viterboana* and *huancavillcas*, refer to the form distinguished from typical *proteus* by having the sub-basal band on the under side of the secondaries fused with the two spots usually found above it in the costal area, thus forming a rather broad, continuous band which is sometimes more or less widened at the top. In some individuals the apex of the claspers of the male genitalia is more produced than in others which have the same form as found in typical *proteus*.

Goniurus metallescens (Mabille)

1888. *Eudamus metallescens* Mabille, Le Natur., 10 Ann., Ser. 2, ii, p. 108. [Manes, Brazil.]

1891. *Goniarus piliger* Mabille, Ann. Soc Ent. Belg , xxxv, p lx. [Itaituba]

1893. *Eudamus piliger* Mabille & Vuillot, Nov. Lep., fasc. 11, p. 110, pl. 15, fig. 3.

1893. *Eudamus metallescens* Godman & Salvin, Biol. Centr.-Amer., Rhop., ii, p. 285, pl. 75, figs. 27, 28, and 29. (♂ genitalia.)

1921. *Polythrix metallescens* Draudt, in Seitz, Macrolep., v, p. 852, pl. 166c.

Piliger is a synonym of *metallescens*. The type of *metallescens* is without doubt a female as stated by Godman and Salvin, while the Mabille and Vuillot figure of *piliger*, clearly showing the tuft of hair on the under side of the primaries toward the base, is very evidently that of a male. The figure of *metallescens* given by Godman & Salvin shows four subapical spots on the primaries, while those of *piliger* by Mabille & Vuillot and *metallescens* by Draudt show but three such spots. Male specimens from Peru in the Bell collection show but three subapical spots on the primaries and agree in all particulars with the Mabille & Vuillot figure, and they also agree in the form of the male genitalia with the figure given by Godman & Salvin for *metallescens*. The spelling of "*Goniarus*" by Mabille in the original description appears to have been a typographical error.

Goniurus virescens (Mabille)

1877. *Eudamus virescens* Mabille, Bull. Soc. Ent. France, 1877, p. xxxix. [Cayenne.]
1880. *Goniurus herophilus* Plotz, Bull. Soc. Nat. Moscou, lv, p. 16. [Rio.]
1890. *Eudamus virescens* Mabille & Vuillot, Nov. Lep., fasc. 14, pl. 11, figs. 6, 7.
1921. *Eudamus herophilus* Draudt, in Seitz, Macrolep., v, p. 856, pl. 161b.
1925. *Eudamus chlorothrix* Rober, Ent. Mitteil., xiv, p. 160. [Huacabamba, Central Peru.]
1926. *Eudamus virescens* Williams, Trans. Amer. Ent. Soc., lii, p. 68, fig. 5. (♂ genitalia.)

There do not appear to be any characters mentioned in the description of *chlorothrix* to distinguish it from Peruvian specimens of *virescens* in the Bell collection and that of the Academy in Philadelphia, and the name is undoubtedly a synonym. Typical *virescens* has brown fringes in the outer angle area of the secondaries but occasional individuals have them white in this place and show no difference in the genitalia.

The Mabille & Vuillot figures show two apical dots on the under side of the primaries which are missing on the upper side. Our series show from two very minute dots to three rather heavy ones.

Goniurus octomaculata (Sepp)

1848 *Hesperia octomaculata* Sepp, Surinam Vlind , ii, pl 58.
1869. *Eudamus* (*Goniurus*) *decurtata* Herrich-Schaffer, Corres.-Blat. Regensburg, xxiii, p. 170. [Locality not given]
1880 *Goniurus decurtatus* Plotz, Bull. Soc Ent. Moscou, iv, p. 5. (Plotz drawing no. 11)
1888. *Eudamus calenus* Mabille, Le Natur , 10 Ann. 2d Ser., ii, p. 99, fig. 3. [Guatemala]
1893. *Eudamus octomaculatus* Godman & Salvin, Biol. Cent.-Amer., Rhop., ii, p. 284, pl. 75, fig. 23. (♂ genitalia)
1917. *Eudamus octomaculata* Draudt, in Seitz, Macrolep., v, p 857, pl 161d (*maculata* on plate).
1917. *Eudamus decurtatus* Draudt, in Seitz, Macrolep., v, p. 857, pl 161e.
1926. *Eudamus octomaculata* Williams, Trans. Amer. Ent Soc., lii, p. 85, fig. 29. (♂ genitalia.)

Decurtata Herrich-Schaffer appears to be a synonym of *octomaculata* Sepp. The Herrich-Schaffer description and the figure given by Draudt, both agree with specimens of *octomaculata* at hand. The Draudt figure is presumably taken from the Plotz drawing of the Herrich-Schaffer type. Herrich-Schaffer did not include *octomaculata* in his paper although it is a rather common species, and it does not seem unreasonable to assume that he either overlooked the Sepp figure or did not recognize his insect to be the same and redescribed it as *decurtata.*

The Draudt figure of *octomaculata* differs from that of *decurtatus* in the absence of the extra discal spot. Our series show some without this spot, some with the spot just indicated, and some with the spot rather large, so this is a variable character.

The figure of *calenus* Mabille shows a whitish line below the outer band of the secondaries below. While this is not evident in most of our series, it is indicated, or present on some of them.

Aguna eudoxus (Cramer)

1782. *Papilio eudoxus* Cramer, Pap. Exot., IV, p. 146, pl. 366, figs. G, H. [Surinam.]

1921. *Eudamus eudoxus* Draudt, in Seitz, Macrolep., v, p. 856, pl. 161c.

The Cramer figures appear to represent a species of *Aguna* allied to *coelus* Cramer and *gideon* Plotz. The shape of the discal hyaline band of the primaries is a little different and the extra-discal and subapical hyaline spots are absent, these characters separating it from the two species mentioned.

Aguna leucogramma (Mabille)

1888. *Eudamus leucogramma* Mabille, Le Natur. 10 Ann., 2d Ser., II, p. 109, fig. 3. [Porto Cabello.]

The description and figure indicate that this is an *Aguna* allied to *albistria* Plotz.

Goniurus nivosus Plotz

1880. *Goniurus nivosus* Plotz, Bull. Soc. Imp. Moscou, LV, p. 17. [Blumenau.]

form **loxo** Mabille

1903. *Eudamus loxo* Mabille, Gen. Ins , XVII, 21 (footnote). [Santa Catharina, Brazil]

There have been many conceptions as to the identity of this insect by various authors. The writers have received from collectors at Blumenau and other nearby localities in the Province of Santa Catharina, Brazil, a number of specimens of *Goniurus* belonging in the *doryssus-albimargo* group, all of which are undoubtedly of the one species, containing no specimens of either *doryssus* or *albimargo.* This seems to indicate that the species received is the prevailing one, if not the only one, inhabiting that particular region and is more than likely that described by Plotz as *nivosus*. The Plotz description is not very well supplied with details but the insects in question agree with it well enough. The discal hyaline band and the subapical spots of the primaries are much reduced, in well marked specimens quite similar to those of *albimargo* Mabille, but in some individuals the discal band is absent except for a small spot at the costal margin and a small subapical spot, the upper one near the costa. The inner margin of the primaries beneath is sometimes entirely dark or in other cases lighter brown than the disc of the wing. The outer margin of the primaries beneath often contains some white scales intermixed with the brown, as do the fringes. The white marginal band of the secondaries beneath is suffused with brown scales toward the costal margin.

The insect superficially resembles *albimargo* Mabille but the male genitalia differs from that species in the less broad apex of the terminal arm of the claspers and in this respect is more like the form found in *doryssus* Swainson from which *nivosus* is readily separable by the superficial appearance.

Specimens of *nivosus* Plotz which have a distinct outer marginal white band on the primaries beneath and with white or partly white fringes of these wings are referred to the form *loxo* Mabille. There is no difference in the genitalia between the two forms.

Mabille states in his description that the type locality of *loxo* is Santa Catharina, Brazil, although in his list of species in the genus he gives Colombia, probably in error. All of the specimens in the collection of the writers are from Blumenau and other localities in the Province of Santa Catharina, Brazil.

Goniurus doryssus (Swainson)

1831. *Eudamus doryssus* Swainson, Zool. Ill., Ser. 2, II, pl. 48, fig. 2. [Bahia.]

1888. *Eudamus leucites* Mabille, Le Natur., 10 Ann., 2d Ser., II, p. 98, fig. 2. [Colombia.]

1931. *Goniurus albicuspis* Shepard, Lep. Cat., pt. 47, p. 28 (as synonym of *doryssus*).

Discussion of the above synonymy will be found under *albicuspis*.

Hydraenomia orcinus (Felder)

1866. *Eudamus orcinus* Felder, Reise Novara, Lep., II, p. 510, pl. 71, figs. 4, 5. [Bahia.]

1894. *Hydraenomia albicuspis* Godman & Salvin (not Herrich-Schaffer), Biol., II, p. 347 (as synonym of *orcinus*, fide Staudinger).

1922. *Hydraenomia albicuspis* Draudt (not Herrich-Schaffer), in Seitz Macrolep., v, p. 881 (as synonym of *orcinus*).

The above synonymy is also discussed under *albicuspis*.

Telegonus albicuspis (Herrich-Schaffer)

1869. *Eudamus albicuspis* Herrich-Schaffer, Corres. Blat. Regensburg, xxiii, p. 188. [No locality given.]
1882. *Eudamus albicuspis* Plotz, Stet. Ent. Zeit., xliii, p. 91. [South America.]
1903. *Eudamus albicuspis* Mabille, Gen. Ins., xvii, p. 22. [Brazil.]
1907. *Thymele* (?) *albicuspis* Godman, Ann. & Mag. Nat. Hist., ser. 7, xx, p. 134.
1921. *Eudamus albicuspis* Draudt, in Seitz Macrolep., v, p. 856, pl. 168b. [Colombia; Brazil.]

The above bibliography indicates the uncertainty of the identity of *albicuspis* Herrich-Schaffer, but if the Draudt figure can be accepted as representing the Plotz drawing of the Herrich-Schaffer type (and it does not disagree with the description), then *albicuspis* is probably a *Telegonus*, although Herrich-Schaffer included it among a lot of species belonging to several of the modern genera.

This agrees with Plotz, who placed it following *latimargo* Herrich-Schaffer, and with Godman, who stated that it was a "*Thymele* (?) near *phalaecus* G. & S." The description of *albicuspis* cannot be reconciled with the characters of maculation found in *Hydraenomia orcinus* Felder, in the synonymy of which Godman & Salvin placed it on the authority of Staudinger and followed in this by Draudt who had already on a previous page listed *albicuspis* as a good species.

Mabille placed *albicuspis* as a good species, with his *leucites* as a synonym, but the description of *albicuspis* and the Draudt figure of it cannot possibly be reconciled with Mabille's figure and description. *Leucites* appears to be a large, well marked *doryssus*, probably a female, and the writers consider it to be synonymous with *doryssus* Swainson.

The Draudt figure, presumably taken from the Plotz drawing, does not show the secondaries to be tailed but to be rather elongate and terminating in a rather sharply pointed anal angle, the primaries have two white superimposed spots near the center of the costa but no further evidence of a discal hyaline band, such as is found in *doryssus*.

The exact identity of *albicuspis* will have to await material more nearly agreeing with the description than any of the insects to which it has heretofore been allied.

Goniurus dorantes (Stoll) race **obscurus** Hewitson

1867. *Eudamus obscurus* Hewitson, Hesp., p. 7. [No locality given.]

1904. *Eudamus brevicaudata* Lathy, Proc. Zool. Soc. London, 1904, p. 453. [Dominica.]

1920. *Eudamus parvus* Skinner, Ent. News, XXXI, p. 134. [St. Pierre, Martinique; English Harbor, Antiqua; Dominica.]

1926. *Eudamus parvus* Williams, Trans. Amer. Ent. Soc., LII, p. 64, pl. 2, fig. 3 (type of *Eudamus parvus* Skinner).

Capt. N. D. Riley of the British Museum informs the writers that Hewitson described his *Eudamus obscurus* from a specimen presumably loaned to him by Boisduval and that this specimen marked "type" is now in the British Museum Collection. It came from Guadeloupe, West Indies.

The lack of information as to the type locality in Hewitson's description has caused the identity of *obscurus* to be more or less of a mystery and the rather obscure description of *brevicaudata* by Lathy has been generally overlooked, the insect being generally known under the name of *parvus* Skinner. Mr. F. E. Watson pointed out to the writers some time ago that *brevicaudata* and *parvus* were the same insect.

The absence of all hyaline spots of the primaries, or their very great reduction in numbers and size when they are present, the small size of the insect and the very short tails of the secondaries distinguishes this race of *dorantes* Stoll from all other races and forms of that species. It appears to be restricted to certain of the Lesser Antilles and is represented in our collections by specimens from Montserrat; Guadeloupe; Dominica; Martinique; St. Kitts.

Polygonus lividus Hubner

1775. *Papilio amyntas* Fabricius (not Poda), Syst. Ent., p 533.

1816–26. *Polygonus lividus* Hubner, Saml. Exot. Schm., pl. 144, figs. 1, 2, 3, 4.

1925. *Polygonus histrio* Rober, Ent. Mitteil., XIV, p. 161. [Panama.]

race **arizonensis** Skinner

1911. *Erycides amyntas* var. *arizonensis* Skinner, Trans. Amer. Ent. Soc., XXXVII, p. 209, pl. 10. [Florence, Arizona.]

1925. *Polygonus amyntas pallida* Rober, Ent. Mitteil., XIV, p. 161. [Peru.]

The characters given by Rober to separate his *histrio* from *lividus* Hubner may be found in most any adequate series of *lividus* and his name appears to synonymous with *lividus*. Individuals of this species present a wide range of variation in the shade of the ground color of the upper surface of the wings and in the absence or presence of a bluish sheen in the basal area of the primaries. On the under surface of the wings the range of variation is just as wide in color and in the distinctness of the darker bands of the secondaries. Individuals present sometimes what appears to be a difference in the width of the primaries, which is more apparent than real, and may be caused in spreading the specimens or in the sagging of the primaries afterwards. One may select individuals from a series which present both extremes of this seeming difference in wing-width, but if an attempt is made to sort up the whole series on this basis it will be found impossible to do so, as every gradation between the two will be found. There is not the slightest difference in the form of the male genitalia in any of these variations. The species enjoys a very extended geographical range, being found in the southern and southwestern United States, Mexico, Central and South America to southern Brazil and many of the West Indies.

Pallida Rober is a synonym of *Polygonus lividus* race *arizonensis* Skinner. The pale form of *lividus* from arid regions, with the bands of the secondaries more prominently shown on the upper surface of those wings, apparently occurs within the geographical range of the species wherever the climatic conditions are favorable to producing it. Although the name *arizonensis* was used to designate a race occurring in the state of Arizona, it should be applied to the arid region race wherever it occurs, as there can be no real purpose served in designating by different names insects from various localities, which cannot be distinguished from each other except by the locality label.

There are specimens in the Bell collection from Arizona; Mexico; Guatemala and Bolivia, of this pale race, which are indistinguishable from each other on their superficial characters and if the locality labels were removed it would be impossible to determine from which locality they came.

Telegonus pseudochalybe (Herrich-Schaffer)

1869. *Eudamus pseudochalybe* Herrich-Schaffer, Corres. Blat. Regensburg, XXIII, p. 185. [No locality given.]

1917. *Telegonus creteus* form *pseudochalybe* Draudt, in Seitz Macrolep., v, 863, pl. 167e. [Brazil.]

On the basis of the characters given by Herrich-Schaffer for this insect, it does not seem that it can be a form of *creteus* Cramer as Draudt has placed it. While the brief description by Herrich-Schaffer leaves much to be desired, it does definitely state certain characters, confirmed in the Draudt figure, which are absent in *creteus* or any of its forms. These are two superimposed white spots near the center of the costa on the under side of the primaries, and the green basal area on both wings beneath. *Creteus* usually has a narrow green or greenish costal stripe, in the basal half, on the under side of the primaries but not a definite green basal area and in a large number of specimens examined there has been no trace of the two white spots. The writers have seen no specimens which can be identified as *pseudochalybe* but, as it does not appear to be a *creteus* form, believe that the name should hold specific rank until the identity can be established, rather than be included in the *creteus* forms where it may be overlooked or cause confusion.

Telegonus habana (Lucas)

1857. *Eudamus habana* Lucas, in Sagra, Hist. Cuba, p. 624.

1922. *Telegonus habana* Draudt, in Seitz. Macrolep., v, p. 864, pl. 167d.

1927. *Telegonus habana* Williams, Trans. Amer. Ent. Soc., LIII, p 284, fig. 27. (♂ genitalia.)

race **antiquus** Skinner

1920. *Telegonus antiquus* Skinner, Ent. News, XXXI, p. 133. [San Domingo]

1924. *Telegonus domingensis* Joicey & Talbot, The Ent., LVII, p. 39.

1927. *Telegonus antiquus* Williams, Trans. Amer. Ent. Soc., LIII, p. 282, pl. 24, fig. 8 (type).

Antiquus is the race of *Telegonus habana* Lucas occurring in San Domingo and Haiti. It is chiefly distinguished from the Cuban insect by the extreme reduction of the whitish overscaling in the outer marginal area of both wings beneath.

Telegonus fulgerator (Walsh)

1774. *Papilio fulgerator* Walsh, Naturf., p. 115, pl. 1, figs. 2a, b.

1925. *Thymele albifasciatus* Rober, Ent. Mitteil., XIV, p. 96. [Rio Songo, Bolivia.]

Albifasciatus Rober is a synonym of *fulgerator* Walsh, a very variable species with a wide geographical range. In the series of *fulgerator* at hand the subapical spots of the primaries range from three to five; the discal hyline band may consist of large spots in a continuous line or some of the spots may be reduced forming a rather irregular line, the small spot in the base of interspace 3 is sometimes entirely absent, Mexican specimens usually have a very narrow, linear band and lack all trace of the white spot at the lower end of it in interspace 1 beneath. The white costal stripe from the base of the secondaries beneath is characteristic of the species, this stripe is cut by a short dark basal line and above this is often yellowish. This basal white line varies in length from a short, somewhat triangular spot, to a long white stripe extending the entire length of the costal margin, and in one aberrant individual it is entirely lacking. The dark bands on the under side of the secondaries also present a wide range of variation.

Thorybes drusius (Edwards)

1883. *Eudamus drusius* Edwards, Can Ent., xv, p. 211. [Arizona.]
1917. *Thorybes paucipuncta* Dyar, Proc. U. S. Nat. Mus , LI, p. 4. [Sierra de Guerrero, Mexico.]

The type of *paucipuncta* is a male of *drusius* the name becoming a synonym of the earlier described species.

Eutychide hyperythrus (Kaye)

1913. *Euroto hyperythrus* Kaye, Trans Ent. Soc. London, 1913, p 575 [Near Port of Spain, Trinidad.]
1931. *Eutychide insulanus* Bell, Jour. N. Y. Ent. Soc., xxxix, p 525, pl. 40, fig 4 (♂ genitalia.) [Trinidad.]

We are informed by Mr. W. J. Kaye, of London, England, that *insulanus* is a synonym of his *hyperythrus*, both from Trinidad. The insect belongs, however, in the genus *Eutychide* and not in *Euroto*, as is well evidenced by the form of the stigma of the male.

Talides vibex (Geyer)

1832. *Thymelicus vibex* Geyer, Zutr. Hub. Exot. Schm., p. 22, figs. 685, 686. [West Indies.]
1919. *Lerema hypozona* Dyar, Proc. U. S. Nat. Mus., LIV, p. 339. [Sierra de Guerrero, Mexico.]

The type of *hypozona* is a female of *vibex* and the name thus becomes another synonym under that species.

Epinosis angularis (Moschler)

1876. *Pamphila angularis* Moschler, Verh. Zool. Bot. Ges. Wien, XXVI, p. 335. [Paramaribo.]

1900. *Metiscus atheas* Godman, Biol. Cent.-Amer., Rhop., II, pl. 100, fig. 21. (♂ genitalia.) (Not description or fig. 20.)

1913. *Epinosis angularis* Schaus, Proc. Zool. Soc. London, 1913, p. 366, pl. 53, fig. 1. [Costa Rica.]

We discuss the above synonymy under *atheas*.

Metiscus atheas Godman

1900. *Metiscus atheas* Godman, Biol., II, 563, pl. 100, fig. 20 (not fig. 21).

Figure 20 of Godman represents the wing and stigma of *atheas* but figure 21 represents the ♂ genitalia of *angularis* Moschler. The stigma is somewhat similar in the two species, but *angularis* differs in not having the part between veins 2 and 3 curved but like a rather long, narrow triangle with a sharp apex at the rise of vein 3 and the base on vein 2, the inner edge lying parallel with the median vein; the small stripe below vein 2 is much alike in both species and is not mentioned in the description of the genus *Epinosis*, of which *angularis* is the type. The primaries of *angularis* are much less elongate than those of *atheas*.

Thracides (?) variegata (Hewitson)

1870. *Hesperia variegata* Hewitson, Equat. Lep., p. 73. [Ecuador.]

1931. *Thracides* (?) *currani* Bell, Jour. N. Y. Ent. Soc., XXXIX, p. 528, pl. 40, fig 8. (♂ genitalia.) [Dutch Guiana.]

Currani is a synonym of *variegata* Hewitson, the description of which Mr. Bell has recently seen and compared with his own species. A photograph of the type of *currani* was sent to Captain Riley at the British Museum who kindly compared it with the Hewitson type of *variegata*, and he has confirmed the fact of the synonymy. The Academy collection in Philadelphia has a male from Hacienda La Mascota, Rio Topo, Ecuador, 4,500 ft. elev. caught by Mr. W. Judson Coxey, April 16, 1931. This species is omitted by Draudt in Seitz Macrolepidoptera. It is possibly not a *Thracides* but agrees no better with any of the other described genera. Hewitson's type is a female.

ON THE MALE GENITALIA OF CERTAIN SPECIES

The preparations and drawings for the following species were made by Mr. Bell.

Tarsoctenus plutia (Hewitson) (Pl. IV, fig. 1)

1857. *Pyrrhopyga plutia* Hewitson, Exot. Butt., II, Pyrrhopyga pl. 2, fig. 7, text. [River Amazon.]

The uncus terminates in a rather slender arm with a pointed apex. A short rounded flange projects forward from the base on each side. The saccus is short. The aedoeagus is short and thick, carrying a cluster of heavy internal spines. The claspers are symmetrical and broad, they terminate in an upturned hook with a sharply pointed apex, back of which there is an irregular flange on the dorsal edge from which projects a round process carrying a number of short, heavy teeth.

Tarsoctenus herrichii (Herrich-Schaffer) (Pl. IV, fig. 2)

1869. *Erycides herrichii* Herrich-Schaffer, Corresp.-blatt. d. zool.-min. Ver. Regensburg, XXIII, p. 168. [No locality given.]

1879. *Erycides herrichii* Plotz, Stett. Ent. Zeit., XL, p. 407. [Surinam.]

The form of the male genitalia is the same as that of *plutia*, differing only in slight detail. The aedoeagus, in addition to the cluster of heavy spines, also has a row of smaller ones.

Tarsoctenus rufibasis Boullet

1910. *Tarsoctenus rufibasis* Boullet, Bull. Soc. Ent. France, p. 60. [St. Jean du Maroni, French Guiana.]

1912. Mabille & Boullet, Ann. Scie. Nat. Zool., 9th ser., XVI, p. 24, pl. 1, fig. 1.

The form of the male genitalia is identically the same as that of *herrichii*, and as the insects differ only in the presence of pre-apical hyaline spots in *herrichii* and the lack of them in *rufibasis* it is doubtful that they are specifically distinct. In the two specimens of *herrichii* at hand, one has three pre-apical hyaline spots and the, other two which shows that this character is not stable.

Tarsoctenus papias (Hewitson) (Pl. IV, fig. 6)

1857. *Pyrrhopyga papias* Hewitson, Exot. Butt., II, Pyrrhopyga pl. 1, fig. 4, text. [River Amazon.]

The uncus lacks the developed basal flanges of *plutia*. The claspers terminate in an obliquely upturned point, the pre-apical dorsal flange is long, the apex rounded and inwardly produced in a sharp point and carries a number of short teeth. The aedoeagus has a cluster of internal spines.

Hypocryptothrix teutas (Hewitson) (Pl. IV, fig. 8)

1876. *Erycides teutas* Hewitson, Ent. Month. Mag., XII, p. 251. [St. Paulo, Amazons.]

The uncus is long and slender, terminating in a point and without basal flanges. The aedoeagus is slender. The claspers are bifid at the apex, the lower part deeply notched in the center, forming two short flanges, the lower one broad and obliquely truncate without serrations, the upper one broad, hooked obliquely outward, with several short teeth, immediately back of this flange rises another short and shagreened flange, curved inwardly and carrying some short teeth. The upper part of the two apical sections is long, narrow and tapering to a sharp shagreened point, curved downward over the upper of the two flanges composing the lower section of the apex.

Pyrdalus corbulo (Cramer) (Pl. IV, fig 3)

1782. *Papilio corbulo* Cramer, Pap. Exot., IV, p. 122, pl. 354, fig. a. [Surinam.]

1882. *Celaenorrhinus corbulo* Plotz, Berlin Ent. Zeit., XXVI, p. 253.

1903. *Pyrdalus corbulo* Mabille, Gen Ins., XVII, p. 60.

1876. *Eudamus praestes* Hewitson, Ann. & Mag Nat. Hist., 4th ser., XVIII, p. 353. [Cayenne.]

The original description of *praestes* Hewitson omits many important details of the secondary sexual characters of the male, the presence of which in the type has been confirmed to the writer in a letter from Capt. N. D. Riley. These consist, on the upper side of the primaries, of a costal fold and a patch of modified scales in interspace 1 toward the base. On the underside of these wings in interspace 1 and corresponding to the patch on the upper side, is an oval area of peculiar, yellowish-white scales surrounded by a large area of iridescent scales.

On the secondaries above there is a prominent tuft of dark brown hairs lying between veins 7 and 8 near the base and on the under side of these wings in a corresponding position there is a patch of modified scales. The discal edge of the abdominal fold is densely covered with long, dark brown hairs, on the upper side of the wings.

The uncus is short and terminates in four short prongs, and a short flange projecting forward from the base on each side. The aedoeagus is long and slender and carries some short internal spines near the apex. The right clasper tapers slightly toward the apex, which has the dorsal angle produced into a short, slender, inwardly oblique tooth and with a few small serrations on the outer edge. The left clasper is similar to the right but the apex is more rounded externally. In the accompanying figure the uncus is turned a little to one side.

The figure of the genitalia of *Anastrus corbulo* Cramer, given by Lindsey,[1] appears to represent *Anastrus neaeris* Moschler. The specimens in the writer's collections are from St. Laurent, French Guiana; Obidos, Brazil; Iquitos, Peru.

Goniurus bridgmani (Weeks) (Pl. IV, fig. 5)

1902. *Thymele bridgmani* Weeks, Proc. New England Zool. Club, III, p. 6. (Ill. Diurn. Lep., L, p. 89, pl. 38, fig. 1, 1905.) [Bolivia.]

The form of the male genitalia is very similar to that of *ridens* Hewitson, the termination of the claspers being more produced into a narrow, serrate arm than in *ridens* as figured by Godman & Salvin in the Biologia Centr.-Amer.

Goniurus nigricauda (Godman & Salvin) (Pl. IV, fig. 4)

1893. *Eudamus nigricauda* Godman & Salvin, Biol. Cent.-Amer., Rhop., II, p. 274. [Chiriqui, Panama; Colombia.]

The form of the male genitalia is very similar to that of *albimargo* Mabille, to which *nigricauda* is most closely allied.

Codatractus aminias (Hewitson) (Pl. IV, fig. 7)

1867. *Eudamus aminias* Hewitson, Descr. One Hundred New Species Hesp. (1), p. 4. [Minas Geraes, Brazil.]
1875. Exot. Butt., v, Eudamus, pl. 2, fig. 14.

The form of the male genitalia is similar to that of *alcaeus* Hewitson, the lower terminal arm of the claspers a little different in shape and more produced and the dorsal apical flange more irregular. The aedoeagus carries a long, branched, internal spine.

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[1] Denison Univ. Bull., XXI, pl. 27, fig. 2 (1925).

EXPLANATION OF PLATE IV

MALE GENITALIA

Fig. 1.—*Tarsoctenus plutia* Hewitson. Manicore, Brazil.

Fig. 2.—*Tarsoctenus herrichii* Herrich-Schaffer. Dutch Guiana.

Fig. 3.—*Pyrdalus corbulo* Cramer. Obidos, Brazil.

Fig. 4.—*Goniurus nigricauda* Godman & Salvin. Trinidad, British West Indies.

Fig. 5.—*Goniurus bridgmani* Weeks. Yungilla, Ecuador.

Fig. 6.—*Tarsoctenus papias* Hewitson. Iquitos, Peru.

Fig. 7.—*Codatractus aminias* Hewitson. Paraguay.

Fig. 8.—*Hypocryptothrix teutas* Hewitson. Iquitos, Peru.

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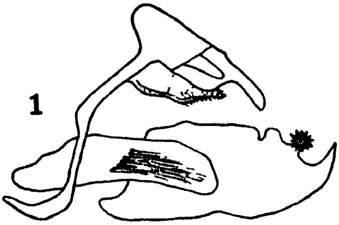

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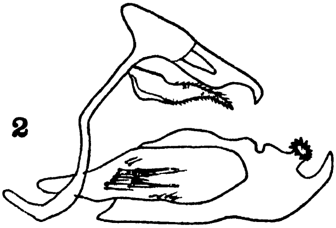

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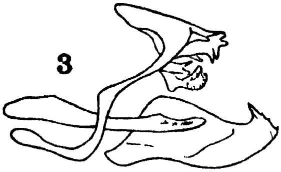

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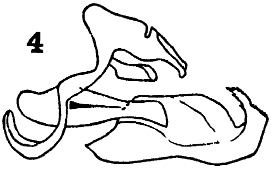

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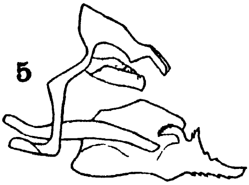

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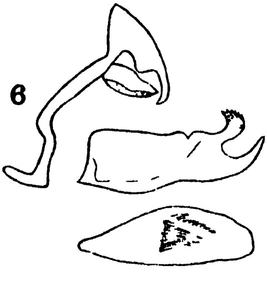

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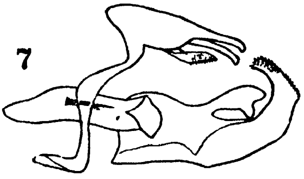

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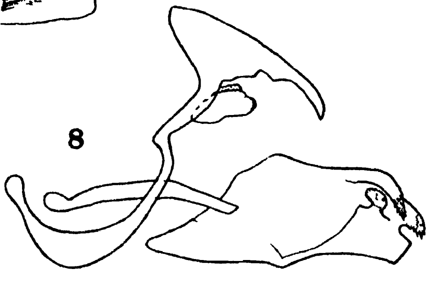

WILLIAMS AND BELL—AMERICAN HESPERIOIDEA

COMPARISONS OF THE MOUTH-PARTS OF ADULT LONGHORN BEETLES WITH REFERENCE TO THEIR FOOD

(COLEOPTERA: CERAMBYCIDAE)

BY EDWARD H. GOLDMAN

(Plate V)

The material herein incorporated represents the results of an effort to ascertain whether or not there exists a correlation between the mouth-parts and the food material of certain adult Cerambycid beetles. I am greatly indebted to Dr. Philip P. Calvert for his valuable assistance and guidance in this work. I am also under obligations to Mr. J. N. Knull for suggestions pertaining to literature on the subject.

METHOD

Since dried, preserved material was used, the beetles were put in a relaxing jar for twenty-four to forty-eight hours. The mouth parts were then dissected off, dehydrated, cleared and mounted on slides in balsam in the usual manner.

All drawings reproduced on the accompanying plate were made by camera lucida.

The literature concerning the food habits of the beetles was then carefully examined to learn the food material of the adult beetles studied. There is a paucity of information on this subject. In many cases it is but vaguely known. The cases where it is positively known are relatively few. The bulk of the data concerning the food habits deals with the larvae. In many cases, however, there is a resemblance between the structure of the mouth parts of the adult and larva. This fact is often a clue to the habits of the former.

GENERAL FOOD HABITS OF THE GROUP

Beetles of this group are of great economic importance, since they are almost entirely plant-feeders, many of their number being destructive to timber. In practically all cases the damaging agent is the larva, which makes galleries in the timber. Many of the beetles are therefore commonly known as "Wood Borers." While the food of the adult is sometimes the same as that of the larva, it is more often totally different. While the larva usually feeds upon wood, living, dead or decayed, the adult usually feeds upon foliage and more often upon pollen. However, since the adult must bore its way through the timber during emergence from the pupal stage, its mouth parts may therefore in a measure be said to be adapted to the food material of the larva. In many cases this furnishes the only point of association.

Schiodte (1863) classifies adult beetles of the family Cerambycidae with reference to their mouth-parts, which he considers adapted to their food habits. With this criterion he arrives at three groups, which in the accepted classification of today are the subfamilies, Cerambycinae, Prioninae, and Lamiinae. The first group, of which he considers *Leptura* the prototype, feeds exclusively on pollen. The members of the second group, of which he considers *Prionus* the prototype, are equipped with large and strong mandibles to enable them to bore their way out of the timber at the end of metamorphosis. The third group he insists feeds upon a more substantial type of food than pollen and has therefore a comparatively greater development of the maxillae and labia. He does not, however, mention the type of food. It is understood, of course, that he is referring throughout to the Danish forms.

The collector's method of obtaining the Longhorns reasonably indicates the food plants of many of them since he "will obtain many species of this family by carefully beating branches (especially if partially dead) and flowers over a sheet or an umbrella" (Wickham, p. 81). The fact that traps and bait pans, containing molasses and water in a slightly fermented condition, will attract many adults, especially of the subfamily Cerambycinae, (Champlain and Kirk, pp. 289–290) makes it not unreasonable to suppose that these same insects are attracted to flowers upon which they feed. Curiously enough the insects which were taken in the bait pans belong to Schiodte's first group, which feed exclusively on pollen.

Craighead's (p. 13) statements concerning food of the beetles may be condensed as follows: "The Cerambycids are all phytophagous, for the most part attacking arborescent plants although a few are found in herbaceous growths. Those species feeding on living trees are more often restricted to a single species or genus of trees. . . . The conifers and deciduous or hardwood trees present barriers that are rarely crossed. *Orthosoma* and a few species of *Leptura* attack either, but the wood must be well decayed." Some of these statements are contradicted by other authors and curiously enough sometimes by Craighead himself.

From this general account we may now proceed to consider the insects studied individually, following the arrangement of Bradley.

SUBFAMILY CERAMBYCINAE

Eburia quadrigeminata (Pl. V, figs. 1–4)

The larva of this insect "lives in the trunk of honey locust, hickory and probably also in the ash" (Beutenmüller, p. 75). Champlain, Kirk and Knull (p. 105) report that "this species was found breeding in the hard outer shell of a partly decayed maple." Adults were taken on dead beech and elm. Craighead (pp. 11, 66) states that the larva of *E. quadrigeminata* is a heartwood borer and that it prefers dry solid wood. From the former, however, it is seen that the larva is a borer in relatively hard wood, of which hickory is probably the hardest. The ash is probably its most common food plant since the insect is commonly known as the "Four Marked Ash Borer." Its mandibles are quite adequate for the purpose of boring its way through the wood after metamorphosis since they are equipped with sharp points and are of a quite substantial size. As seen in figure they are short and broad.

The food of the adult is probably pollen and other floral parts since they are attracted plentifully to bait pails of fermenting molasses. The hairy structure of the labium and more especially the labrum makes it easy for the insect to retain pollen in its mouth while feeding. The ligula is also deeply cleft, which condition Schiodte regards as correlated with pollen feeding. The cleft ligula he assumes to be a result of the entire insect lengthening itself in an effort to adapt itself to fit the flowers upon which it feeds. The maxillae are also quite hairy, as indeed is the case with most pollen feeders. Craighead (p. 66) reports the finding of adults under the bark of elm and beech, but does not specify whether they were newly emerged, ovipositing or feeding. Since the mere finding of specimens in certain plants does not necessarily indicate that these are the food plants, it is not possible to state what this signifies. The structure of the mandibles, however, would make feeding possible if such be the case.

Elaphidion mucronatum (Pl V, figs. 5–7)

The larva "bores in twigs of oak, hackberry, palmetto and grapevine" (Beutenmüller, p. 75). Champlain, Kirk and Knull (p. 106) report that the insect has been reared from dead branches of maple; Knull (p. 85) that it has been reared from dead sweet fern. Craighead (p. 70) makes mention of the fact that the larvae eat a great variety of hardwoods. As in the former case the mandibles are likewise adaptable to the chewing of hard wood, since they are sharply pointed and have several teeth. They no doubt aid in the emergence.

The food of the adult is here again probably pollen, since the insects are attracted plentifully to bait pails. The hairy structure of all of its mouth-parts adapts it to its particular food. Here again the ligula is deeply cleft, as in all pollen-feeders. A particular feature of the mandible is that it possesses two small brushes of hairs along its inner contour.

The mouth-parts of this insect resemble closely those of other species studied, particularly *Elaphidion atomarium.*

Elaphidion atomarium (Pl. V, figs. 8–11)

The food material of this insect is largely similar to that of *E. mucronatum.* The mouth-parts are likewise similar except for the mandibles, which are much more robust in proportion to the size of the insect than those of the former. A striking peculiarity of *E. atomarium* is the fact that its left mandible differs markedly from the right one by having an extra tooth. The structure of the mouth-parts would adapt the insect admirably to the feeding on pollen, though its mandibles would aid in boring even to a greater degree than in *E. mucronatum.*

Cyllene robiniae (Pl. V, figs. 8–11)

The larva feeds upon the locust and is very destructive to it, and is therefore commonly called the "Locust Borer." The adult beetle according to Craighead (p. 9) feeds upon pollen, leaves, bark of tender twigs and on the pustules of certain fungi. According to Metcalf and Flint (p. 668) the adult feeds upon the flowers of goldenrod and a few allied plants. Champlain and Kirk (p. 290) and Champlain and Knull (p. 256) report it to be numerous in bait pails.

The ligula, although not quite as hairy as in the preceding insect, is deeply cleft. The labrum is not excessively hairy, the maxillae are normally so. The mandibles are relatively small without teeth, smooth and practically hairless. They are quite well adapted to the softer plant material upon which the adult feeds, but one wonders how they are able to bore through the locust bark upon emergence, though to be sure locust is not the hardest of woods.

Cyllene pictus (caryae) (Pl. V, fig. 15)

The larva is mostly found in hickory though it has been reported on elm, walnut, butternut and occasionally in honey locust. Hickory is, however, its most common food plant. It is to this tree that it is extremely damaging, earning its common name of the "Painted Hickory Borer." The adult, as shown by Dusham (p. 189), who dissected the alimentary tract for food remains, feeds only on pollen.

The mouth-parts resemble those of *C. robiniae* very strikingly, except for the mandibles which are quite different. The mandibles of *C. pictus* narrow down to a very sharp tip. These are no doubt quite able to bore the very hard hickory wood as the adult must do following metamorphosis. Correlated also with its pollen-feeding habits is the brush of small hair on the inner contour of the mandibles.

Xylotrechus colonus (Pl. V, figs. 16–18)

According to Craighead (p. 57) the larvae feed upon the bark of all eastern hardwoods. Mundiger reports that the "larvae, pupae, and adults are often found in yellow birch" (p. 319). Beutenmüller states that the larva "bores under the bark of maple, oak and hickory" (p. 76). According to Fisher and Kirk the species has been "reared from hickory bark, elm, thorn and other trees" (p. 311). The insect is then clearly a wood-borer in its larval state. As to the food of the adult there is very little information, though its attraction to bait pails (Champlain and Kirk, p. 290) probably indicates its feeding on pollen and other floral parts.

The mouth-parts in many respects resemble those of other pollen-feeders. The labrum is moderately hairy, as is the labium. There is a singular departure, however, in the labium of this insect as compared with the other two members of the tribe Clytini, which have been mentioned. The ligula is but feebly bilobed, there being no distinguishable cleft. Instead, the lobes are separated by a shallow curved sinus. The size of the ligula is different in that it is much subordinated to the palps. The maxillae are normally hairy. The mandibles, although bearing a small brush of hair on their inner surfaces, appear to be more adapted to vigorous chewing of hard material, since they have markedly notched teeth as well as pointed tips. Here again they are probably used by the insect in boring its way to the outside world. The food habit correlation, though present, is not as marked, in my opinion, as it is in the mouth-parts of some other species.

Leptura nitens (Pl. V, figs. 29–31)

The adults of most of the species of *Leptura* are pollen-feeders according to Craighead (p. 91). The same author states that the larvae feed on the living bark of chestnut, which is not excessively hard, and that the insect is an exception in that it is the only larva, so far as known, which attacks living trees. According to Schiodte, *Leptura* is the prototype of all the pollen-feeders.

The mouth-parts of the adult are typically adapted to the food material mentioned. The labium has its ligula narrowly cleft, resulting in two large shallow panlike appendages. The palps are subordinate to them in size. Both are well supplied with hairs. The labrum is somewhat different from the other labra thus far considered, in that it is somewhat longer and somewhat more sharply notched in the center. This is probably an adaptation to the shape of the head rather than to the food of the insect. The maxillae are also quite hairy. The mandibles have a long brush of hair on their inner contours. They differ also in the fact that part of the upper surface proximad is rugose resembling minute teeth in profile. The mandibles are devoid of teeth though they have sharply curved tips. In my opinion the mouth-parts of this insect are more nearly correlated to its feeding habits than any of the others previously examined.

Leptura vittata (Pl. V, figs. 19–20)

According to Blackman "very little is known of this species regarding its host trees" though they are "taken in large numbers from blossoms of wild spirea" (p. 126). The same author states that they are bred from dead larch and are doubtless in spruce and balsam roots. Craighead says that the larva attacks wet, dead or decaying wood and has been found in decaying pine logs. Fisher and Kirk (p. 313) have found many adults on flowers. This species is, therefore, like most other species of the same genus in that the larva attacks a variety of woody and subligneous material, while the food of the adult is probably of a floral nature.

The mouth-parts are practically the same as those of *L. nitens*, except that the labrum is a little shorter and the mandibles a trifle more robust, having more jagged tips. The correlation of food and mouth-parts I would judge to be the same as that for *L. nitens*.

Leptura vagans (Pl. V, figs. 25–28)

There is very little difference in food habits and mouth-parts in any of the Lepturae which I have considered. We, therefore, do not find any marked difference in either aspect in this species. The larva has been found boring in yellow birch, hickory and decaying pine logs. It has also been taken in scrub oak and the insect has been bred in butternut, hickory and birch. Fisher and Kirk (p. 313) report that it has been reared from hemlock and that the adult has been found on flowers.

The mouth-parts are practically the same as those of Lepturae already considered except for a small membranous structure proximad to the brush of hairs on the mandibles. When compared with the other two species of *Leptura* this is an entirely new departure. As to its function, I can conceive of it as an aid in the retention of pollen. Whether the insect is more dependent upon pollen as to warrant this extra mandibular structure than the former two species is likewise a question that I cannot answer.

Leptura rubrica

There is very little that can be said of this insect's food or mouth-parts that has not already been mentioned in connection with the other species of *Leptura.* Its food is possibly somewhat more limited.

As for its mouth-parts they are not sufficiently different from the others described to warrant separate drawings or discussion.

Typocerus sinuatus (octonotata) (Pl. V, figs. 21–24)

Practically all authors report the larva of this insect as feeding upon decaying hard wood, including hickory and conifers. Since, however, the wood is decayed any degree of softness may be encountered. Fisher and Kirk (p. 313) report the adult on flowers and Champlain and Knull (p. 256) report *Typocerus velutinus*, plentiful in bait pails. While this is not the species which we are considering, it is possible the adult of *sinuatus* likewise is attracted to flowers and pollen since it is not unreasonable to suppose a similarity in the food of species of the same genus as the consideration of *Leptura* has shown. A study of the mouth-parts of the adult further justifies our assumption that the animal is strongly dependent upon flowers for food.

The mouth-parts are very markedly lengthened, no doubt correlating with the long slender head which must pry its way into slender flowers. An examination of the maxillae shows the stipes and galea to be lengthened to a proportion not met with in any of the other insects considered. Likewise the submentum of the labium is equally markedly elongated. The labrum follows this example though to not so noticeable a degree. As with all pollen feeders the mouth-parts are plentifully endowed with hairs and the usual cleft ligual is present. The mandibles are also remarkable in that the membranous structure mentioned for *L. vagans* is quite large and almost equal in length to the brush of hairs.

The set of mouth-parts is not one which would be especially efficient for a boring mode of existence. Since, however, the larva and pupa feed upon decayed wood, it can not be an especially hard task for the adult to bore through this rotten material at the close of pupal life. The correlation here is therefore very definite.

Desmocerus palliatus (Pl. V, figs. 40–44)

According to Craighead (p. 87) the larva feeds on the living roots of *Sambucus* and bores only in the pith of the stem. Beutenmüller reports it "in the lower parts of the stems of elder" (p. 77) and Fisher and Kirk (p. 312) state merely that the larva has been found on elder. From the above it is seen that the food of this insect is not of a hard nature. The root and pith may be considered comparatively soft. I have been able to find no positive notation of the food material of the adult, though its mouth-parts make justifiable the conclusion that it is a pollen-feeder.

Here again the ligula is moderately bilobed and plentifully supplied with hairs. The labrum is likewise hairy, though it shows no signs of being cleft. The maxilla is also quite hairy. The mandibles are not of the strongly boring type, being relatively squarely truncated at the apex. However, owing to the comparatively soft food material, their inefficiency in boring is not a detriment to feeding. Emergence would then be comparatively simple were it not for the puzzling question as to how the insect eats its way from the pith to the outside of the plant. It is difficult to believe that it is accomplished by boring through the hardest wood since the mouth-parts do not warrant such activity. It is more possible that the insect finds its way out through the tender twigs, roots or crevices in the trunk. As to the actual circumstances I have been able to find no data.

Purpuricenus humeralis (Pl V, figs 32–35)

The food of this insect again warrants its being considered as a typical pollen-feeder, whose larvae are wood borers. Knull states that they have been reared from dead black locust (p. 63) while Fisher and Kirk (p. 311) report oviposition in oak stumps. Champlain and Kirk (p. 290) and Champlain and Knull (p. 257) say that the adult has been taken very plentifully in bait pails. The same is reported by Frost and Dietrich (p. 436). From the food of this insect, it is reasonable to suppose its mouth-parts to be similar to those of other pollen-feeders.

An examination shows this to be the case. The maxillae, the labrum and the labium are supplied with abundant hairs, while the ligula is as usual cleft, its component lobes being rather large. The mandibles are again equipped with a brush of hairs. They are rather robust and have a conspicuous pointed tooth approximately one-third from the tip. This would no doubt be a valuable aid in boring or sawing.

Callidium antennatum (Pl. V, figs. 36–39)

This insect is commonly known as the "Blue Pine-Borer" and is usually confined to the tree from which it gets its name. Felt (2, p. 660) mentions the fact that the larva bores in pine and cedar but is chiefly restricted to the dry wood. Craighead (pp. 11, 47) states that the larva bores between the bark and the wood and is often found on dry seasoned pine logs. Beutenmüller states that the insect "breeds under the bark of pine and cedar, making tortuous galleries" (p. 75). Mundiger remarks that the insect is "often attracted to seasoning spruce lumber" (p. 319). Presumably this is the adult, but whether it is attracted for purposes of feeding or oviposition he does not state. There is no definite statement by any of these authors as to the food-habits of the adult.

In many respects the mouth-parts resemble those of the pollen-feeders mentioned. It is possible, therefore, that this insect is likewise a pollen-feeder. The labrum and labium are quite hairy and the ligula is characteristically bilobed, though to be sure the lobes are quite small. The palps of the labium are quite large and have hatchet-shaped terminal joints resembling those of beetles of the family Coccinelidae. The galea and lacinia of the maxilla are rather short in proportion to the maxillary palp, whose terminal joint resembles that of the corresponding joint on the labial palp. The maxillae are also quite hairy. The mandibles have no brush of hairs on their inner surface, but are instead equipped with two teeth and a prominent tip. They are well adapted to boring in dry wood and are no doubt used by the adult in leaving the tree. The mandible is not typical of pollen-feeders, but since this structure is not the most important one in such feeding, its features may still be considered reasonably compatible with pollen feeding. On the whole this insect is neither a very marked proof for or against correlation between food and mouth structure.

SUBFAMILY PRIONINAE

Prionus laticollis (Pl. V, figs. 45–48)

According to Craighead (p. 27) the larvae of the entire Prioninae feed consistently on dead wood and at the base of soft wood trees. They are also known to hollow roots. Beutenmüller says that the larva "lives in trunk and roots of linden, poplar, oak, chestnut, apple, pine and grapevine" (p. 74). Wickham reports that "the larva is said to injure the grape, poplar, apple and pine by boring in the roots" (p. 83). From this it is seen that soft food material is usually preferred. This is rather strange when an examination of the mouth-parts is made.

This species presents a different set of mouth-parts from those which we have mentioned previously. The following passage from Schiodte (pp. 190–191) will, I believe, prove interesting. He refers to adults of a group of which this species is a member.

"Here the demands on the perforating power of the mandibles become so overwhelming that there is neither space, time, nor strength left for developing the mouth for any other purpose. The mandibles are increased in size and modified in shape far beyond the limit allowed by the former type, and become clumsy saws, scissors, chisels or pincers—all in the service of generation alone, and not at all in the service of nutrition. They monopolize almost the whole bulk of the muscles which the head can accommodate. The other parts of the mouth, labium, maxillae and labrum are often, as it were, merely sketched in their development, or play the part only of pads filling up space round the bases of the mandibles. The maxillae often remain undeveloped except the palp, and all parts and appendages of the labium coalesce. This is the type represented by the Prioni and those forms which will subsequently be pointed out as their nearest relatives.'' The author, although clearly distinguishing between nutrition and generation, does not explain his use of the latter term. Whether by generation he means boring through at adult emergence, the grasping of the mate during copulation or possibly some other process, is not clear.

The mouth-parts of *P. laticollis* adult are quite unique in several respects. To begin with, the mandibles are very large and jagged, having menacing and pointed teeth. The right mandible has an entirely different shape from the left. Both mandibles are practically devoid of hair. Clearly they are well adapted to gnaw almost any type of hard woody material. It is curious, therefore, to note that the insects are more often confined in their feeding to decayed wood and the roots of trees which are softer than woody sections. The other mouth-parts are very much underdeveloped as a possible result of the great development of the mandibles. The labium is very much subordinated to the labial palps, which do not suffer diminution. The ligula is insignificant. The labium is moderately hairy. A similar underdevelopment is seen in the maxillae, where instead of the normal galea and lacinia there is but a lacinia with no vestige of the former. The palp again has suffered no reduction. The labrum is very small and simple, having no lobular characteristics. Instead its cephalic contour is shallow and concave, with but few hairs.

There is not much correlation here either with pollen-feeding or the boring of softer woods. The only reasonable correlation would suggest association with harder woods, but of that there is no mention.

Orthosoma (Derobrachus) brunneum (Pl V, figs. 54–57)

The food material of this insect is very much like that of *Prionus laticollis.* Felt (2, p. 487) states that the larva is found entirely in decayed wood such as pine, hemlock, hickory, oak, chestnut, walnut and nearly all forest trees. Fisher and Kirk (p. 309) report larvae collected in oak stumps and rotten logs. Wickham says, "I have found larvae in rotten pine timbers under sidewalks" (p. 83). Beutenmüller asserts that the larva "bores in decaying pine, hemlock and probably other coniferous trees, also in hickory, walnut, oak and chestnut" (p. 74). They are unanimous, therefore, that the food of the larva is decayed wood. The species is consequently of little economic importance.

Here again it is difficult to see any correlation between the mouth-parts of the insect and its food, since the mouth-parts are similar to those of *P. laticollis*. The mandibles are very large and armed with jagged teeth, the basal fourth of the inner contour having a small brush of hairs, which is so characteristic of pollen-feeders. Here again the mandibles differ from each other in shape. They appear to be powerful borers. The labrum resembles that of *P. laticollis*, and the labium is but slightly different. The ligula is somewhat larger and is in no way cleft. The palps also are shorter in proportion. The labium is quite hairy. The maxillae are complete and differ from those of *P. laticollis* in that they have both galea and lacinia. They are also normally hairy. The palp is quite proportionate.

The definite relation of the adult to the food of the larva exists at the time of emergence. Here there can not be a strong correlation between mouth-parts and food for reasons already stated. What the further food of the adult is I have been unable to ascertain.

SUBFAMILY LAMIINAE

Monochammus titillator (Pl. V, figs. 49–52, 58)

This insect is commonly known as the "Pine Sawyer." According to Craighead it is a characteristic pine feeder. Beutenmüller states that "larvae of this genus bore in the solid wood and large branches of pine, fir, and probably other coniferous trees" (p. 78). Felt (p. 362) makes mention of the fact that members of the genus have well developed mandibles to make their way through the wood as adults. Those larvae which can not bore through the wood because of weaker mouth-parts bore parallel to the axis of the tree. Of the adult food we have this statement by Craighead, "adult beetles feed extensively before ovipositing on the needles of conifers" (p. 106).

A study of the mouth-parts reveals the insect to be intermediate between a pollen-feeder and a borer or sawyer. The labrum is long and well provided with hairs. The labium is unique in that it resembles none of the labia heretofore considered. The ligula is flattened with a circular notch of moderate size in the center. This is edged by a fringe of hair. The maxillae are quite broad at their bases and narrow out toward the galea, lacinia and palp. They are moderately hairy. The mandibles are practically devoid of hair and teeth and have exceedingly sharp tips. They are, therefore, well adapted to saw pinewood upon emergence and in later adult life to chew pine needles.

This insect I would consider presents mouth structures which are definitely correlated with its diet.

Tetraopes tetraopthalmus (Pl. V, figs. 64–67)

This insect both in the larval and adult stage feeds upon the milkweed. Beutenmüller reports that "the larva bores in the roots and lower parts of the stem of milkweed" (p. 81). The larvae of the other species of the genus probably also live in a similar manner. Weiss and Dickerson state that "when the beetles first appear, they feed upon the young leaves. Later the flower buds appear and these are eaten and lastly the flowers are devoured" (p. 125). They refer to *Asclepias*, the milkweed.

The mouth-parts of this insect are in some ways unique. The labium and labrum are only moderately hairy. The labrum is one which broadens to mid-length. The ligula is not cleft but instead is slightly concave at the apex. The palps of the labium are of moderate size. The maxillae are quite as usual. The mandibles are unique in that they are strongly tapering to a blunt tip. There are no marked teeth, but instead the protuberances are well rounded. The upper part of the tip is furnished with a small brush of hairs. These mouth-parts are well adapted for the comparatively soft material of the milkweed plant. The absence of pollen as a major part of the diet is reflected in the sparseness of hair on the labrum and labium just as the softer food is reflected in the rounded surfaces of the mandibles.

Saperda candida (Pl. V, figs. 59–63)

This insect is commonly known as the "Apple Tree Borer," the larva doing most of the damage. Since its host is a valuable fruit tree, the beetle is of great economic importance. Brooks (Bull. No. 886, pp. 4, 7) reports that, "After transforming to adults the insects remain within the pupal cell for from one to two weeks and then gnaw their way out through the bark . . . after emergence the beetles seek the foliage of the trees and feed at times rather freely on the bark and twigs and leaf petioles and occasionally on the leaves. . . . The beetles feed rather freely on the tender bark, a favorite place of feeding being the thickened bark around the base of small twigs." The adult is then clearly a feeder on woody or subligneous material.

The structure of the mouth-parts is quite in keeping with the diet described. Both the labrum and labium are practically hairless, the ligula of the labium being unique in that it is somewhat thickened and with an aggregation of small tubercles about its center. This, no doubt, is of value in grinding. The palps are moderate. The maxillae are quite normal though less hairy than some of the other species studied. The mandibles are practically devoid of all hair. They are narrow and taper to a fine point while curving slowly distad. They are slightly different from each other in the matter of a vestige of a tooth. Whether this difference is constant or whether it merely constitutes an individual variation, I do not know. In my opinion there is a definite structural relation to the diet.

Oberea ruficollis (Pl. V, figs. 68–71)

Not much is known of the food habits of the adult insect. Craighead states that "so far as known, all [species of *Oberea*] attack living plants, usually the smaller branches which they completely hollow and kill" (p. 135). He further states that *O. ruficollis* larvae eat stems and roots of living sassafras. It is apparent then that the young plants do not form an especially hard type of food for the insects.

The mouth-parts are reasonably adapted to the diet mentioned. The labrum and labium have small amounts of hair, while the ligula is but faintly notched in the center. The palps are moderate. The maxillae are less hairy and are perhaps slightly broader than in other species. The palp is also somewhat longer. The mandibles are devoid of hair and are slender with sharp tips. They are quite adequate for the chewing of young plants. They are also adequate for the adults' emergence from the food plant at the close of metamorphosis.

Oberea tripunctata (Pl. V, figs. 72–74)

The food of this insect is similar to that of *O. ruficollis.* According to Craighead (p. 137) the larva girdles branches of plum, quince, apple and peach trees. Blackman states (p. 131) that the insect is said to breed in the stems of wild blackberry. Knull (1932, p. 64) reports that it has been reared from branches of living mocker nut hickory (*Carya alba* Linn.) and witch hazel (*Hamamelis virginiana* Linn.), consequently not as hard as the woody material used by other beetles.

The mouth-parts are practically similar to those of *O. ruficollis*, except that they are smaller in accordance to the smaller body size. The labrum is broad and sparsely haired; the maxillae and labium are for all purposes of comparison practically like those of *O. ruficollis*. The mandibles are somewhat slenderer, ending in a finer tip. Here again the structural correlation to diet is the same as that for *O. ruficollis*.

Conclusions

From the preceding account certain definite conclusions may be drawn. In nearly all cases in the subfamilies Cerambycinae and Lamiinae there is a correlation between mouth-part structure and diet. Those insects which feed on pollen usually have markedly hairy mouth-parts. In nearly all cases a cleft ligula is also associated with this type of adult feeding. This is especially true of the species of *Leptura* in the subfamily Cerambycinae and in *Saperda candida* in the subfamily Lamiinae. In cases in the same two subfamilies where there is no definite correlation there is at least possibility of such and not a definite negation. Such insects as *Desmocerus palliatus, Oberea ruficollis*, etc., while not showing striking correlation may be considered in the group. In insects such as *T. tetraopthalmus, M. titillator* and *S. candida*, whose food habits involve material other than pollen, the mouth-parts are not especially hairy. The most noticeable reduction in hairiness is seen in the maxillae. There is also a lack of a cleft ligula in these insects, though there is sometimes a faint indication of such a cleft.

The members of the subfamily Prioninae do not in my opinion show an obvious correlation with the food material. The mouth-parts are adapted, with respect to size and shape, to active sawing and boring of the hardest type of wood, yet the insects themselves are confined to dead and decaying wood. Further work on their food as adults will perhaps reveal other and harder materials as food. The previous conclusion is drawn only with reference to what is now known of the insects' diet. Considered from an evolutionary point of view it is possible that the large mandibles are a result of specialization in spite of changing food materials.

The mouth-parts, exclusive of the mandibles, are correlated with the adult food in a decidedly more marked fashion than are the latter. The mandibles, though in many cases adapted to the food of the adult in a lesser manner, are more specially concerned with adult emergence and larval food. This is true in all cases except in the members of Prioninae studied, where there is no correlation whatever. In pollen-feeding, as is the case with members of the subfamily Cerambycinae, there is little need for mandibles. They may thus be considered as merely persisting from larval and pupal life. On the other hand the maxillae, labium, and to some extent the labrum, as far as figures of the larval mouth-part indicate, are noticeably different in the adult, as is the food material. Except for the members of the subfamily Prioninae, my results confirm the original deductions of Schiodte.

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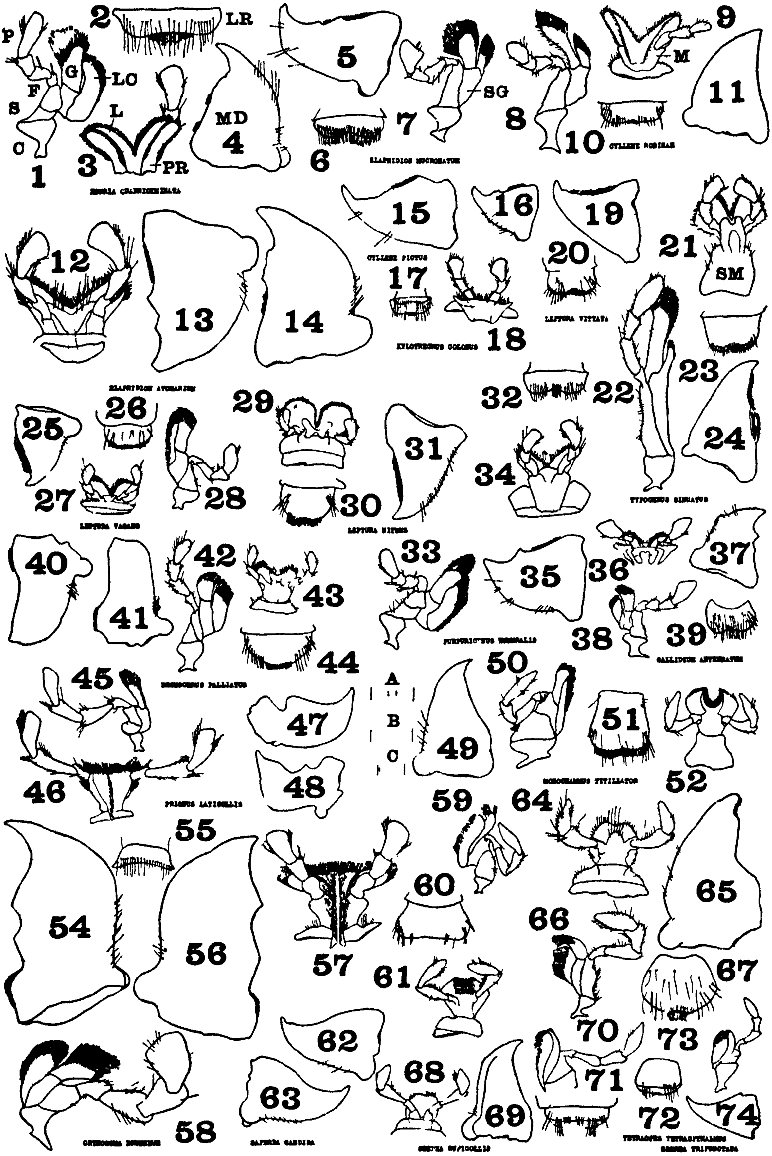
Explanation of Plate V

Figs. 1–4.—*Eburia quadrigeminata*
Figs. 5–7.—*Elaphidion mucronatum*
Figs. 8–11.—*Cyllene robiniae*
Figs. 12–14 —*Elaphidion atomarium*
Fig. 15.—*Cyllene pictus*
Figs. 16–18.—*Xylotrechus colonus*
Figs. 19–20.—*Leptura vittata*
Figs. 21–24.—*Typocerus sinuatus*
Figs. 25–28.—*Leptura vagans*
Figs. 29–31.—*Leptura nitens*
Figs. 32–35.—*Purpuricenus humeralis*
Figs. 36–39 —*Callidium antennatum*
Figs. 40–44.—*Desmocerus palliatus*
Figs. 45–48.—*Prionus laticollis*
Figs. 49–52.—*Monochammus titillator*
Figs. 54–57.—*Orthosoma brunneum*
Fig. 58.—*Monochammus titillator*
Figs. 59–63.—*Saperda candida*
Figs. 64–67.—*Tetraopes tetraopthalmus*
Figs. 68–71.—*Oberea ruficollis*
Figs. 72–74.—*Oberea tripunctata*

C.—Cardo
F.—Palpifer
G.—Galea
L.—Ligula
LC.—Lacinia
LR.—Labrum
M.—Mentum
MD.—Mandible
P.—Palp
PR.—Prementum
S.—Stipes
SG.—Subgalea
SM.—Submentum

Figures 1 to 39, 64 to 74 are drawn to scale A; 40 to 44 to scale B; 45 to 48 to scale C. Scales are marked off in one-tenth millimeters.



GOLDMAN—MOUTH-PARTS OF CERAMBYCIDAE

NOTES ON PANAMANIAN DERMAPTERA AND ORTHOPTERA

BY MORGAN HEBARD

(Plates VI and VII)

The present paper deals with the Dermaptera and Orthoptera which have been collected and sent to us for study since the appearance of the last of our studies on these Orders for Panama.[1] The collections represented are the following. A large series, mainly from Barro Colorado Island in Gatun Lake, Canal Zone, was collected by James Zetek and belongs to the author. Another equally important from there and Bocas del Toro was secured by J. Chester Bradley and belongs to Cornell University, but we are permitted to retain the specimens important to us for future studies in return for other species desired by that institution. A smaller collection mainly from the same Island and from

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[1] A Contribution to the Knowledge of the Dermaptera of Panama, *Trans. Amer. Ent. Soc.*, XLIII, pp. 301 to 334, (1917).

The Blattidae of Panama, *Mem. Amer. Ent. Soc.*, No. 4, pp. 1 to 148, (1920).

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Studies in the Mantidae and Phasmidae of Panama (Orthoptera), *Trans. Amer. Ent. Soc.*, XLVIII, pp. 327 to 362, (1923).

Studies in the Acrididae of Panama (Orthoptera), *Trans. Amer. Ent. Soc.*, L, pp. 75 to 140, (1924).

Studies in the Tettigoniidae of Panama (Orthoptera), *Trans. Amer. Ent. Soc.*, LIII, pp. 79 to 156, (1927).

Studies in the Gryllidae of Panama (Orthoptera), *Trans. Amer. Ent. Soc.*, LIV, pp. 233 to 294, (1928).

Supplementary Notes on Panamanian Dermaptera and Orthoptera, *Trans. Amer. Ent. Soc.*, LV, pp. 389 to 400, (1929).

Previously Unreported Tropical American Blattidae in the British Museum (Orthoptera), *Trans. Amer. Ent. Soc.*, LV, pp. 345 to 388, (1929). [Only a few records.]

Ancon was made by Nathan Banks and belongs to the Museum of Comparative Zoology. A small series was assembled near Gatun, Canal Zone and Porto Bello by T. O. Zechokke for the California Academy of Sciences. The ownership is given in each case for the other scattered records.

Again the great majority of the records are from the Canal Zone or nearby localities. The Bocas del Toro series is, however, considerably more satisfactory than any previously made in that region, faunistically showing some distinct differences from the Canal Zone and agreeing very closely with that of the Estrella Valley of Costa Rica.

The present paper records four hundred and eighty-three specimens, representing one hundred and forty-four species, of which those previously undescribed are as follows; Dermaptera one, Blattidae five, Phasmidae one, Acrididae one, Tettigoniidae two, Gryllidae one. Two new genera are also described.

The total number of species for Panama now stands at thirty-eight species of Dermaptera and four hundred and sixty-nine of Orthoptera, the latter divided as follows. Blattidae one hundred and seventeen, Mantidae twenty-four, Phasmidae forty, Acrididae seventy-five, Tettigoniidae one hundred and twenty-nine, Gryllidae eighty-four. When more nearly complete we believe the number of species for Panama in the families of the Orthoptera will, however, be in the following sequence: Blattidae, Tettigoniidae, Gryllidae, Acrididae, Phasmidae and Mantidae.

The comments made in our 1928 paper as to the present knowledge of the Dermaptera and Orthoptera of Panama apply equally well today. We greatly hope that extensive field work will be undertaken not only in the vicinity of Chiriqui Volcano (and particularly on its western slopes) but also in the practically unknown mountains toward the Colombian border.

Intensive collecting on Barro Colorado Island already shows how many species can be found in a limited area of tropical forest. At present the following number of species have been recorded from that island. Dermaptera seven; Orthoptera: Blattidae thirty, Mantidae ten, Phasmidae three, Acrididae seventeen, Tettigoniidae forty-four, Gryllidae thirty-two.

DERMAPTERA

LABIDURIDAE

Psalis americana (Beauvois)

Barro Colorado Island, Canal Zone, V and VI, 1930, (J. Zetek), 1♂ (comparatively small, slender), 1 juv. Ancon, C. Z., VI, 1919, (J. Zetek), 1 ♀, 1 juv.

Spandex percheron (Guerin and Percheron)

Barro Colorado Island, C. Z., VI, 27, 1930, (J. Zetek), 1♂.

This handsome insect was previously known only from South America. Decided color variation occurs. In the present specimen the pronotum is light clear orange-brown like the limbs, the wing pads are unusual in lacking a pale spot and are only a slightly paler brown than the ground coloration of the tegmina.

LABIIDAE

COSMOGERAX new genus

The genus is very distinctive, but apparently shows strongest affinity to *Eugerax* Hebard Tarsal claws without arolia. First antennal joint distinctly shorter than any of the distal joints. Wings extending beyond tegmina much less than tegminal length. Forceps specialized, metaperameres concealed. Antennae with third joint conical; fourth, fifth and sixth pyriform; succeeding joints more elongate, simple. Pronotum decidedly narrower than head, metazona decidedly and evenly ascending caudad. Eye large, over twice as long as cheek. Tegmina moderately elongate, slightly over twice as long as pronotum. Head, pronotum, tegmina, exposed portions of wings, abdomen and forceps decidedly pilose, the abdomen and forceps with longer hairs. Pygidium and closed simple forceps leaving a narrow cleft in male, entirely touching in female.

Genotype: *Prolabia formica* Burr, described from Bahia, Brazil and at that time recorded from Venezuela and Guatemala.

Cosmogerax formica (Burr)

Barro Colorado Island, C. Z., VII, 20 to VIII, 4, 1924, (N. Banks; from *Atta* dump), 6♂, 5 ♀.

These specimens agree fully with Burr's description and color figure except the pygidium and forceps, which evidently were originally carelessly and much too briefly considerea.

Vostox geayi (Burr)

Tres Rios Plantation, Gatun, C. Z., II, 25 to 31, 1930, (T. O. Zechokke), 1 ♀, [Hebard Cln.]. Barro Colorado Island, C. Z., III, 1924, (J. C. Bradley), 1 ♂, [Hebard Cln.].

Careful consideration of the literature and material of related species received in exchange from the Burr Collection convinces us that though often plastic, many more species of this group occur in the American tropics than Burr had imagined and that his *geayi*, based on a male from "Darien" in 1904, is not a synonym of *Vostox brunneipennis* as assigned by Burr in 1911, with which opinion we concurred in 1917.[2]

The present male differs from any of the large series of *brunneipennis* before us from the United States and Mexico in being smaller, with pygidium convex declivent, scarcely longer than its basal width, with lateral margins straight convergent to the broadly convex apex, the disto-lateral angles of which are acute. The apical width is fully half the length of the pygidium. The forceps have the internal tooth at end of proximal third, but the dorso-internal tooth (normal in *brunneipennis*) at end of proximal two-thirds is subobsolete. The tegmina in both specimens are solidly very dark brown; the limbs pale with tibiae slightly suffused except at their extremities.

Total length ♂ 10.2, ♀ 10.2; length of forceps ♂ 2.6, ♀ 2.2 mm.

Microvostox bilineatus (Scudder)

Barro Colorado Island, C. Z., VIII, 4, 1924, (N. Banks; from *Atta* dump), 1 adult.

Parasparatta panamae new species (Pl. VI, figs. 1 and 2)

This species is closely related to the Brazilian (Rio) *nigrina* (Stål), the Mexican *dentifera* (Rehn), the Panamanian *rehni* Hebard and the Guianan *guyanensis* Hebard.

Without material of *nigrina* sufficient comparisons can not be made, as that insect is described from a female.[3] It is apparently a decidedly darker insect, the forceps described as "subdilatate on the inner side toward the apex, with apex incurved and unarmed."

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[2] Trans. Amer. Ent. Soc., XLIII, p. 307.

[3] Subsequent determinations as *nigrina* are probably all incorrect, referring to related species, that from Panama being most likely to have been based on material of the present species or *rehni*.

Much nearest affinity to *guyanensis*, of the other species, is noted, the female in particular agreeing in having its forceps lacking a proximo-internal flange (or quite as well termed a large acute-angulate produced lamella). The male differs in having the forceps with first internal tooth at end of proximal third and second dorso-internal tooth nearly at end of proximal two-thirds and thus more remote from the apices; in the female the single internal tooth is situated at end of proximal two-fifths (not as near median point) with ventral margin not lamellate and feebly concave to that point but slightly more lamellate than in *guyanensis* beyond, this lamella gradually subsiding toward the apex. The female pygidium is also generally similar to that of females of *guyanensis* but has its projections less decided.

Like in all the above species (except apparently *nigrina*) the ultimate tergite is very pale, the forceps slightly or much darkened as in *guyanensis*. Individual variation known, however, indicates that coloration is of little real aid in distinguishing these species. Great reduction in size also often occurs, this sometimes resulting in the usually diagnostic structural features of the pygidium and forceps being greatly simplified and in extreme cases obliterated.

Type.—♂; XX Plantation six miles east of Porto Bello, Panama. March 17, 1930. (T. O. Zechokke.) [Hebard Collection, Type No. 1229.]

Size very small and form slender. Head greatly depressed, conventional heart-shaped, sutures obsolete. Eyes very small. Antennae and pronotum as described for *rehni*,[4] but collar of latter slightly heavier, as in *guyanensis*. Fully developed tegmina and wings and abdomen as described for *rehni*, but faint impression of ultimate tergite rather bluntly and broadly V-shaped with a medio-longitudinal impressed line. Caudal metatarsus similar to that of *rehni*. Pygidium a produced shaft, three times as long as basal width with dorsal surface convex, the lateral margins broadly concave, disto-lateral angles produced in acute points, the distal portion produced caudad of these in an almost square median lamella. Forceps very feebly curved to the incurved apices, armed as described above (the type, but not the paratype, with moderate lamellation of the ventro-internal margin indicated distad which subsides before the apex without denticulation).

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[4] Trans. Amer. Ent. Soc., LV, p. 390, (1929).

Allotype.— ♀; same data as type. [Hebard Collection.]

Very similar to male, differing as described for this sex of *guyanensis*. Pygidium and forceps as figured and described above.

Generally shining blackish brown, except as follows. Ultimate tergite and pygidium tawny (except in paratypic male in which the latter is russet). Forceps russet (varying to as dark as body in paratypes). Limbs buffy tinged with tawny, the femora proximad and most of the tibiae weakly suffused with brown, but in the male paratype the femora to near their apices and tibiae blackish brown.

The measurements of a paratypic pair from Gatun, Canal Zone, taken on the Tres Rios Plantation by T. O. Zechokke, in March, 1930, follow those of the described pair. Length of body ♂ 5.7 and 5.2, ♀ 6.4 and 6, length of pronotum (not including neck) ♂ .99 and .74, ♀ 1.11 and 1.03; width of pronotum ♂ .80 and .62, ♀ .85 and .82; length of tegmen ♂ 1.56 and 1.06, ♀ 1.53 and 1.49; length of forceps ♂ 2.34 and 2.05, ♀ 2.34 and 2.17 mm.

Labia nodifer Hebard

Barro Colorado Island, C. Z., VII, 23, 1924, (N. Banks), 3 ♀.

Labia dorsalis (Burmeister)

Barro Colorado Island, C. Z., VII, 13 to 22, 1924, (N. Banks), 3♂, 2 ♀. Ancon, C. Z., VI, 1919, (J. Zetek), 2♂.

One male from Barro Colorado Island is very small, slightly less robust than the others and weakly stenolabic with apex of abdomen and the forceps unusually pale.

ORTHOPTERA

BLATTIDAE

CHORISONEURINAE

Chorisoneura fuscipennis Hebard

Barro Colorado Island, C. Z., III, 26 to 31, 1924, (J. C. Bradley), 1♂, 1 ♀, [Hebard Cln.].

Chorisoneura specilliger Hebard

Barro Colorado Island, C. Z., III, 26 to 31, 1924, (J. C. Bradley), 1♂, 1 ♀.

Chorisoneura bradleyi new species (Pl. VI, fig. 3)

This is a very handsome species, agreeing closely with *C. nigrostriga* Hebard, described in 1929 from Gorgona Island, Colombia, in size, form and striking markings of the head and antennae.

It is distinguished by the pronotal markings cephalad and caudad of the disk but particularly by the striking opaque yellow tegminal veins. The latter suggest *C. splendida* Hebard, described from British Guiana, but this coloration in the present insect is as strong on the axillary and ulnar as on the discoidal and median veins and present also on the cross-veinlets and discoidal sectors in less degree.

Type.—♂; Barro Colorado Island, Canal Zone, Panama. March 31, 1924. (J. C. Bradley.) [Hebard Collection, Type No. 1183.]

Size rather large for the genus; form depressed, in outline elongate elliptico-ovoid. Head broad, decidedly depressed; occiput and cephalic portion of eyes exposed dorsad, eyes not projecting beyond interocular area; interocular space moderately broad (.48 mm.), about three-fifths width between antennal sockets; a weak transverse ridge at point of least interocular width (in ventral portion of dark area) below and adjacent to which is a weak transverse sulcus of like width (in dorsal portion of pale area). Pronotum transverse elliptical; cephalic margin very broadly convex but showing greatest convexity above head, caudal margin faintly convex, lateral margins almost straight briefly mesad, thence rounding very evenly and broadly into the other margins; point of greatest width mesad; disk with very weak curved impressions meso-laterad. Tegmina elongate, extending well beyond cercal apices; greatest width at end of proximal quarter, narrowing distad to the rounded but acute apex; marginal field broad, costal veins (15 and 16) fine; discoidal sectors (13) very strongly oblique. Subgenital plate of usual general form for the American species of this genus; styles represented by two elongate flattened fingers which are rounded at their apices and have broad socketed bases, between which mesad is a minute decurved spine. Limbs as characteristic of genus.

Head with occiput light ochraceous orange, a broad blackish brown band between the eyes from their dorsal margins to just below point of least interocular width, below this the face is somewhat opaque buffy. Antennae with first joint and nearly distal two-thirds light ochraceous tawny, second joint tinged with brown, remaining portion blackish brown. Pronotal disk immaculate, light ochraceous orange; area cephalad of it opaque antimony yellow, caudal margin broadly somewhat opaque whitish; lateral portions and tegmina toward costal margins transparent and almost colorless; other portions of tegmina tinged strongly with ochraceous orange, the veins and veinlets opaque antimony yellow, this weakest on discoidal sectors particularly distad. Wings weakly tinged with ochraceous orange, the strongly enlarged apices of the costal veins buffy. Limbs translucent buff tinged with orange. Ventral surface of abdomen opaque whitish with each sternite latero-proximad deep ochraceous orange; subgenital plate and cerci alone uniform dull ochraceous orange.

Length of body 8.7, length of pronotum 2.2, width of pronotum 3.6, length of tegmen 9.7, width of tegmen 3 mm.

ANAPLECTINAE

Anaplecta sordida Hebard

Changuinola District, Bocas del Toro, V, 21, 1924, (J. C. Bradley), 1 ♂, 1 ♀, [Hebard Cln.].

The previously unknown male has the subgenital plate of the type found in *A. lateralis* (Burmeister),[5] but with margin decidedly more convexly produced at the socketed style, more as in *A. fallax* Saussure, another member of the Lateralis Group.

The present specimens are in a better state of preservation than was the type and the head coloration is seen to be as follows; amber brown, occiput (except a small meso-caudal area) and interocular space to mesad on the ocelli darker, chestnut brown. The ventral margin of this marking is evenly and very weakly concave between the ocelli.

Anaplecta asema Hebard

Barro Colorado Island, C. Z., III, 26 to 31, 1924, (J. C. Bradley), 1 ♀.

Anaplecta gemma Hebard

Barro Colorado Island, C. Z., III, 26 to 31, and IV, 4, 1924, (J. C. Bradley). 1 ♂, 1 ♀, [Hebard Cln].

In the previously unknown male the styles are very small, simple, the sinistral very slightly larger than the dextral as in *A. asema* Hebard, but the sinistral margin does not show the minute production just inside the sinistral style which is present in that species.[6]

Anaplecta cabimae Hebard

Barro Colorado Island, C. Z., III, 26 to IV, 7, 1924, (J. C. Bradley), 1 ♀.

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[5] See Hebard, Mem. Amer. Ent. Soc., No. 4, pl. 2, fig. 3, (1919).

[6] See Hebard, Mem. Amer. Ent. Soc., No. 4, pl. 2, fig. 5, (1919).

Riatia[7] **fulgida** (Saussure)

Barro Colorado Island, C. Z., III, 26 and 27, 1924, (J. C. Bradley), 1♂.

This specimen, like the female recorded by us from Paraiso in 1919, is very brilliantly colored; burnt sienna with two striking transverse tegminal bands of blackish brown. Usually this insect is paler and immaculate.

PSEUDOMOPINAE

Euthlastoblatta compsa Hebard

Barro Colorado Island, C. Z., III, 26 to 31, 1924, (J. C. Bradley), 1♀, [Hebard Cln]; VII, 17, 1924, (N. Banks), 1♀.

This sex, previously unknown, is more robust than the male, with reduced tegmina covering only part of the abdomen, their venation poorly indicated in contour, their distal margins obliquely truncate to the broadly rounded apices at the sutural margins.

Latiblattella inornata Hebard

France Field,[8] C. Z., (M. Hebard; under palms on low ground in decaying leaf mould and litter), VII, 7, 1920, 1♀ and VIII, 18, 1920, 1 juv. ♀, 1 very small juv. ♂, [Hebard Cln.].

Latiblattella angustifrons Hebard

Gatun, C. Z., VII, 8, 1920, (M. Hebard; in open country), 1 large juv. ♂, [Hebard Cln.]. Balboa, C. Z., (W. M. Wheeler; in hollow stem of *Triplaris cumingiana*), 1♂, [Hebard Cln.].

Latiblattella bradleyi new species (Pl. VI, fig. 4)

This insect is a close relative of *L. zapoteca* (Saussure) a species known from southern Mexico and Honduras. It differs in the smaller size, the pronotal markings less sharply defined and the head almost solidly dark below the vertex, which is similarly pale with four vertical dark lines.

Type.—♂; Bocas del Toro, Panama. April 24, 1924. (J. C. Bradley.) [Hebard Collection, Type No. 1234.]

Similar in form but appreciably smaller even than *L. inornata* Hebard; smallest of the yet known species of the genus in which

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[7] We have recently published the fact that *Lissoblatta* Hebard must fall as a synonym of *Riatia* Walker.

[8] By an extraordinary error material was labelled "Paris Field" and some has been so recorded, particularly Ent. News, xxxii, pp. 161 to 169, (1921).

the male has fully developed and not at all reduced organs of flight. Head with interocular space three-fifths that between the antennal sockets, slightly wider than in *zapoteca* (comparisons made with material of that species from Honduras); inter-ocular-ocellar area flattened; ocellar spots large. Palpi with third and fifth joints subequal in length, each distinctly longer than the fourth. Pronotum ample, with point of greatest width meso-caudad, surface weakly convex and showing weak lateral deflection Tegmina with discoidal sectors weakly oblique. Wings with costal veins scarcely thickened distad. Abdomen with sixth tergite (not including median segment) with a deeply impressed area showing cephalad a broadly convex ridge projecting briefly from beneath the preceding tergite from which project caudad hairs which radiate regularly, caudad with a pair of straight heavy ridges which converge and meet meso-cephalad, the apex there formed surmounted by a tuft of short agglutinated hairs (this and other features of the abdominal specialization being the type found generally in the species of *Latiblattella,* which apparently differ from each other only in certain slight modifications of the male external genital characters). The impression of the sixth tergite has its lateral margins less convex and the caudal elevation less elongate and not as definitely a triangular elevation as is found in *zapoteca*. Supra-anal plate very broadly transverse, showing very faint sub-bilobation. Flattened finger-like styles inset with slender apices curving mesad out above the asymmetrically lobate meso-distal horizontal portion of the subgenital-plate, the dextral style much the most deeply inset. From within at base of sinistral style a flattened chitinous finger curls meso-distad. Tarsal claws asymmetrical, the shorter projection slightly farther than the large pulvillus.

Allotype.— ♀ ; same data as type. [Hebard Collection.]

Very similar to male. Slightly broader, tegmina and wings slightly reduced, interocular space slightly wider. Dorsal surface of abdomen neither specialized or constricted distad. Supra-anal plate triangularly produced, lateral margins convergent and broadly concave, rounding into the moderately broad, truncate, sub-bilobate apex. Subgenital plate large, raised laterad, weakly produced, dorsal margin weakly concave below cerci, surface meso-distad with a very strong high medio-longitudinal carina.

Head chestnut brown with ocelli and a pair of similar dots just below and between antennal sockets buffy; occiput to median point on eyes between them buffy with four irregular vertical lines of chestnut brown. Palpi, limbs and underparts ochraceous buff, the palpi with all but apex of fourth and fifth joints (and in females all of fifth joint) chestnut brown. Femora and tarsi suffused with brown dorsad, the cephalic femora with disto-cephalic surface similarly suffused. Ventral surface laterad suffused with blackish brown, this with whitish flecks in described pair on abdominal sternite. Subgenital plate of male wholly pale, of females with broadly suffused dark margins but not as dark brown as elsewhere. Pronotal disk ochraceous tawny pictured with prouts brown, these markings less sharply defined than in the allied species in male, in allotypic female fused broadly laterad and in Costa Rican female with such suffusion heavier and meeting cephalad. Tegmina evenly tinged with buckthorn brown, this slightly weaker on their lateral margins and those of the pronotum.

In immatures the head and pronotal disk are solidly blackish brown except for the buff occurring on the former, while the latter have the latero-caudal margins of the marking oblique and weakly concave.

The measurements of the Costa Rican female follow those of the allotype. Length of body ♂ 10.6, ♀ 11.2 and 10.8; length of pronotum ♂ 2.9, ♀ 3.2 and 3.2; width of pronotum ♂ 4.1, ♀ 4.4 and 4.6; length of tegmen ♂ 11.8, ♀ 10.7 and 10; width of tegmen ♂ 3.8, ♀ 3.9 and 3.7 mm.

This species belongs to a difficult group of a difficult tropical North American genus. The group was hitherto unknown from south of Costa Rica.

Specimens Examined: 6; 1 male, 2 females and 3 immature individuals.

La Emilia, Costa Rica, 1000 feet, IX, 15, 1927, (J. A. G. Rehn; in second growth forest), 1 juv. ♀, [Acad. Nat. Sci. Phila.]. Guapiles, Costa Rica, 984 feet, VIII, 11, 1923, (J. A. G. Rehn; at light), 1 ♀, [Acad. Nat. Sci. Phila.].

Changuinola District, Bocas del Toro, Panama, V, 24, 1924, (J. C. Bradley), 1 ♂, 1 ♀, *type* and *allotype*, 2 juv. ♂. On Steamer from Panama at dock in New York, New York, X, 14, 1924, 1 large juv. ♂, [Acad. Nat. Sci. Phila.].

Macrophyllodromia maximiliani (Saussure)

Barro Colorado Island, C. Z., III, 31, 1924, (J. C. Bradley), 1 ♀, [Hebard Cln.].

Macrophyllodromia splendida Hebard

Barro Colorado Island, C. Z., III, 31, 1924, (J. C. Bradley), 1 ♀, [Hebard Cln.].

This specimen is distinguishable from that which we assign to *M. maximiliani* (Saussure) only by its smaller size and lack of maculations on the discoidal fields of the tegmina. The former species was described from Mexico and males from the two countries are needed to verify the present determinations. Though the differences noted are decided, it is possible that they may be attributable to unusual individual variation and *splendida* may indeed prove to be a synonym.

Chromatonotus quarequae new species (Pl. VI, fig. 5)

The present insect is quickly distinguished from all previously known species of this widespread South American genus by the pale and immaculate disk and dark suffused caudal portion of the pronotum.

In size and form it agrees closely with *C. lamprus* Hebard.

Type.—♂; Barro Colorado Island, Canal Zone, Panama. March 30, 1924. (J. C. Bradley.) [Hebard Collection, Type No. 1181.]

In addition to the generic characters,[9] the following are noteworthy. Interocular space four-fifths width between antennal sockets. Ocellar spots large and conspicuous but not quite as sharply defined as in *lamprus*. Enlarged fifth joint of palpus scarcely shorter than third, appreciably longer than fourth. Tegmina and wings much as in *lamprus*; intercalated triangle of latter nearly as wide as deep. Median segment with a very low transverse ridge cephalad armed with very minute scattered spicules and with a scanty fringe of elongate hairs.[10] Supra-anal plate slightly over half as long as wide, free margin broadly and evenly convex between cerci. Subgenital plate curled upward to supra-anal plate sinistrad, not at all reflexed dextrad; styles very small, the dextral with apex toothed, smaller than the simple straight sinistral style and situated directly mesad; between the styles the plate is produced in a flattened twisted finger directed dorso-sinistrad. Concealed genitalia complex; dextrad a large heavy finger springs from base of dextral cercus and is directed mesad, its apex spined and several smaller spiniform teeth distad along its ventral margin; another process present sinistrad, from which one arm projects armed with a short comb of fine apical spiniform teeth.

Head shining blackish brown except buff ocellar spots and mouthparts; antennae, palpi and cerci prouts brown. Limbs light buff. Abdomen ventrad prouts brown paling slightly mesad and with margins light buff; the proximal tergites are prouts brown only along their distal margins. Pronotum with disk very pale ochraceous orange, lateral margins transparent buffy as are the costal margins of the tegmina, caudal portion of pronotum suffused with blackish brown. Tegmina rich chestnut brown except toward costal margins, blackish along humeral trunk proximad. Wings suffused with prouts brown particularly in area of costal veins.

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[9] Described in Mem. Amer. Ent. Soc., No. 4, p. 45, (1919).

[10] The generic description should be emended as follows. "Abdomen with distal surface unspecialized, median segment often with hairs or minute spicules."

In the genotype, *lamprus*, there is a triangular median area of elongate agglutinated hairs lying flat and directed caudad on the median segment. In *C. heterus* Hebard, however, neither hairs or spicules are there present.

Length of body 10, length of pronotum 2.7, width of pronotum 3.7, length of tegmen 9.6, width of tegmen 3.3 mm.

A specimen bearing the same data agrees very closely except in being decidedly smaller. The genitalia show what appears to represent the last instar of a male preceding maturity, though in all other respects this individual is adult. This is apparently a most unusual abnormality; if so, the first of its kind we have ever seen.

Chromatonotus heterus Hebard

Barro Colorado Island, C. Z., III, 26 to 31 and IV, 1924, (J. C. Bradley), 1 ♂, 1 ♀, [Hebard Cln.].

Chromatonotus lamprus Hebard

Ancon, C. Z., III, 10, (A. H. Jennings), 4 ♀, [Hebard Cln.].

Rhytidometopum megalopterum Hebard

Barro Colorado Island, C. Z., IV, 2, 1924, (J. C. Bradley), 1 ♂.

Neoblattella impar Hebard

Barro Colorado Island, III, 26 to 31, 1924, (J. C. Bradley), 1 ♀.

Neoblattella acanthastylata Hebard

Barro Colorado Island, C. Z., III, 26 to 31, 1924, (J. C. Bradley), 1 juv. ♂.

Neoblattella fraterna (Saussure and Zehntner)

Changuinola District, Bocas del Toro, V, 1924, (J. C. Bradley), 1 ♀.

Ischnoptera rufa rufa (DeGeer)

Changuinola District, Bocas del Toro, V, 1924, (J. C. Bradley), 1 ♀. Barro Colorado Island, C. Z., VII and VIII, 1930, (J. Zetek), 1 ♂, 1 ♀.

Ischnoptera panamae Hebard

Changuinola District, Bocas del Toro, V, 1924, (J. C. Bradley), 1 ♀.

Cahita nigripes new species (Pl. VI, fig. 6)

This insect agrees very closely with Mexican material before us of *C. nahua* (Saussure),[11] differing strikingly in the black head and tarsi.

The genus is exceedingly unusual in the great size of the fifth palpal joint, tegmina with longitudinal discoidal sectors, male abdomen with median segment specialized, large arolia and strongly asymmetrical tarsal claws.[12]

Type.—♂; Changuinola District, Bocas del Toro, Panama. April, 24, 1924. (J. C. Bradley.) [Hebard Collection, Type No. 1235.]

Agrees fully with *nahua* in structural characters. Cephalic femora with ventro-internal margin armed with a single heavy proximal spine on one side but none on the other (wide variation in the number of such spines occurs in *nahua*).

General coloration uniform light testaceous, becoming ochraceous orange on ventral surface of abdomen. Femora and tibiae ochraceous buff, the caudal limbs tinged with tawny. Head shining black, the ocellar spots buff. First antennal joint black, second dark brown (others missing). All tarsi black with last joint dark brown and still paler dorso-proximad.

Length of body (abdomen retracted) 9.6, length of pronotum 2.9, width of pronotum 4.1, length of tegmen 12.4, width of tegmen 3.8 mm.

Xestoblatta immaculata Hebard

Chilibri River, C. Z., VIII, 29, 1923, (J. Zetek), 1 ♀.

We would note that in 1914[13] Caudell fully described the male sex of this distinctive species, from material secured in the bat caves of the Chilibrillo River, Panama.

Xestoblatta festae (Griffini)

Barro Colorado Island, C. Z., III, 26 to IV, 7, 1924, 1 ♂, 1 large juv. ♀; IV, 5, 1924, 1 ♀, (J. C. Bradley).

Euphyllodromia tupi Rehn

Changuinola District, Bocas del Toro, V, 1924, (J. C. Bradley), 1 ♀, [Hebard Cln.].

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[11] The species has now also been recorded from Guatemala and Honduras.

[12] See other characters for genus and genotypes; Trans. Amer. Ent. Soc., XLVIII, p. 167, pl. 6, figs. 10 to 12, (1923).

[13] Insecutor Ins. Menst., XII, p. 133.

This handsome South American species was previously known from no further north than Cauca, Colombia.

Euphyllodromia angustata (Latreille)

Barro Colorado Island, C. Z., III, 26 to IV, 7, 1924, (J. C. Bradley), 1 ♂, 1 juv.; VI, 18, 1930, (J. Zetek), 1 ♀. Near mouth of Trinidad River, Gatun Lake, C. Z., III, 25 to 27, 1920, 1 ♂, 2 ♀, [Cornell Univ.]. Ft. Sherman, C. Z., VI, 7, 1924, (J. C. Bradley), 1 ♀.

Euphyllodromia decastigmata Hebard

Barro Colorado Island, C. Z., III, 26 to IV, 7, 1924, (J. C. Bradley), 1 juv.; (J. Zetek), 1 ♀.

NYCTIBORINAE

Nyctibora noctivaga Rehn

Changuinola District, Bocas del Toro, IV, 24, 1924, (J. C. Bradley), 1 ♂. Barro Colorado Island, C. Z., IV, 1924, (J. C. Bradley), 3 ♂, 2 ♀, 1 juv.; V, 1930, (J. Zetek), 1 ♂, 3 ♀, 1 juv.

EPILAMPRINAE

Epilampra azteca Saussure

Changuinola District, Bocas del Toro, V, 30, 1924, (F. R. Swift), 1 ♀, [Cornell Univ.]. Barro Colorado Island, III, 26 to IV, 4, 1924, (J. C. Bradley), 4 ♂, 3 ♀, 2 juv.; V to VII, 3, 1930, (J. Zetek), 1 ♂, 1 ♀.

Epilampra abdomen-nigrum (DeGeer)

Changuinola District, Bocas del Toro, IV and V, 1924, (J. C. Bradley), 1 ♂.

Audreia gatunae Hebard

Barro Colorado Island, C. Z., V to VI, 1930, (J. Zetek), 1 juv. ♀.

Hyporhicnoda litomorpha Hebard

A series of males before us not only show decided variation in size and amplitude of pronotum and organs of flight, but the pronotum varies greatly in contour, the lateral angles broadly rounded and situated latero-caudad in our Panamanian series, similar in the Colombian allotype, but distinctly latero-cephalad in the other Colombian males.

Paraiso, C. Z., I, 25, 1911, (E. A. Schwarz), 1 juv. ♀. Barro Colorado Island, C. Z., III, 26 to VI, 6, 1924, (J. C. Bradley), 1 ♂, 2 ♀, 15 juv.; IV, 1930, (J. Zetek), 1 very small juv.; V to VI, 1930, (J. Zetek), 3 ♂, 2 ♀. San Blas, 1929, (H. A. Pilsbry), 2 large juv. ♂, [Acad. Nat. Sci. Phila.]. On steamer from Panama at New York, New York dock, X, 14, 1924, 1 ♂, [Hebard Cln.].

Hyporhicnoda reflexa (Saussure and Zehntner)

In 1919 we described *Hyporhicnoda*, giving *reflexa* as the genotype.[14]

A series of Costa Rican females of *reflexa* now proves that the male so recorded by us was correctly assigned and that that species occurs in Nicaragua and Costa Rica. Males and females from the lowlands of Panama, however, do not represent that insect but a closely related entity which we here name *humilior.*

Changuinola District, Bocas del Toro, V, 29, 1924, (J. C. Bradley), 1 ♀, 1 small juv. ♂, 1 small juv. ♀, [Hebard Cln.].

This female agrees fully with Costa Rican examples of the same sex before us except that it is somewhat less broad and the pronotum is distinctly less lamellate and less reflexed, much as in *humilior.*

Hyporhicnoda humilior new species

1919. *Hyporhicnoda reflexa* Hebard (in part, (females), not *Rhicnoda reflexa* Saussure and Zehntner, 1893), Mem. Amer. Ent. Soc., No. 4, p. 100, pl. V, fig. 9. Type: ♀; Gatun, Canal Zone, Panama. July 28 to August 5, 1916. (D. E. Harrower.) [Hebard Collection, Type No. 1230.]

All the Panamanian material recorded in 1919 represents the present species, distinguished from *reflexa* in the female sex by the pronotum with cephalic margin distinctly less lamellate and less reflexed particularly mesad, the lesser and not as acute angulate-production of the abdominal tergites, the much smaller apical angulate-emargination of the supra-anal plate; in the male sex by the glossy (not dull) pronotum and tegmina, and in both sexes by the less decided concavity between the eyes and also between the ocelli, the weaker (though heavy) ocellar ridges and narrower interocular space (in females slightly, in males considerably less than width between antennal sockets).

Allotype.—♂; Barro Colorado Island, Canal Zone, Panama. July 3, 1930. (J. Zetek.) [Hebard Collection.]

Differs from the female greatly, as does this sex of *reflexa,* in being smaller, much less broad, with fully developed organs of flight. Characters of difference from males of that species are given above. Both agree and differ from males of other species of *Hyporhicnoda* before us in having the tegminal veins supplied with numerous scattered nodes. Ventro-cephalic margins of cephalic femora with one (usually three) to four heavy spines succeeded by a row of minute (instead of elongate) piliform spines and lacking a distal spine. The other limbs unarmed ventrad (except ventro-cephalic margins of median femora armed with a single median spine in our single male of *reflexa*), but with a small genicular spine.

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[14] Mem. Amer. Ent. Soc., No. 4, p. 98, pl. 5, figs. 8 and 9.

General coloration of male shining mummy brown, cephalic portion of pronotum bounding cuccullation inconspicuously buffy tinged with brown. Ventral surface buffy. Head and limbs buffy tinged with brown, antennae strongly so. Inter-ocular-ocellar area mummy brown.

Careful analyses of the species we have assigned to *Hyporhicnoda* shows that *reflexa* and *humilior* form a distinctive group, but that several variously annectant phyla are represented in the genus and that generic separation of those species would in our opinion be unwise.

The measurements of the female type precede those of one of the smallest female paratypes, length of body ♂ 21.5 and 22.3, ♀ 25.2 and 24.6; length of pronotum ♂ 6.2 and 6.1, ♀ 8 and 8.1; width of pronotum ♂ 9.4 and 9.8, ♀ 12.4 and 12.4; length of tegmen ♂ 21.7 and 22.8, ♀ absent; greatest (distal) width of tegmen ♂ 8 and 8.2 mm.

Specimens Examined: 10; 2 males, 6 females and 2 immature individuals.

Gatun, Canal Zone, VI, 1915, 1 large juv. ♀, VII, 28 to VIII, 22, 1916, 4 ♀, *type* and *paratypes* (all D. E. Harrower, under logs).

Barro Colorado Island. Canal Zone, VI, 1924, (J. C. Bradley), 2 ♀ *paratypes*; VII, 3, 1930, (J Zetek), 2 ♂ *allotype* and *paratype*.

Trinidad River, Panama, VI, 3, 1912, (A. Busck), 1 large juv. ♀, [Hebard Cln.].

Another female from Porto Bello was recorded by us as *reflexa* in 1919.

PANCHLORINAE

Panchlora cubensis Saussure

Changuinola District, Bocas del Toro, IV, 24, 1924, (J. C. Bradley), 1 ♀; V, 29, 1924, (F. R. Swift), 1 ♀. Barro Colorado Island, C. Z., IV, 7, 1924, (J. C. Bradley), 1 ♀.

Panchlora minor Saussure and Zehntner

Barro Colorado Island, C. Z., III, 21, 1924, (J. C. Bradley), 1 ♂, [Hebard Cln.].

Pycnoscelus surinamensis (Linnaeus)

Changuinola District, Bocas del Toro, V, 1924, (J. C. Bradley), 1 large juv. ♀.

BLABERINAE

Archimandrita tesellata Rehn

Changuinola District, Bocas del Toro, V, 1924, (J. C. Bradley), 1♂. Barro Colorado Island, C. Z., V, 1930, (J. Zetek), 1♂, 1♀, 2 large juv. ♂.

The Changuinola male is a large specimen measuring; length of body 60, length of pronotum 18, width of pronotum 29, length of tegmen 71.7, width of tegmen 30.7 mm.

Blaberus giganteus (Linnaeus)

We reported this insect from Panama in 1919 as *B. colosseus* (Illiger), but synonymized that name in 1921. In 1924 Caudell recorded *giganteus* from the Chilibrillo River bat caves.

Barro Colorado Island, C. Z., V, 1930, (J. Zetek), 2♀.

PERISPHAERINAE

More and more data being assembled leads us to believe that the American genera which have been referred to the Perisphaerinae do not properly belong to this subfamily and that *Litopeltis* Hebard and its allies actually represent unusually modified members of the Epilamprinae.

Litopeltis bispinosa (Saussure)

In 1920 we placed *Audreia marginata* Caudell, described from Porto Bello in 1914, as a synonym of this species. In 1928 Rehn added to the genus the Costa Rican *Calolampra biolleyi* Saussure and described from that country five new species and a related genus and species.[15] Of these *L. musarum* from the Estrella Valley, Costa Rica, will probably be found in northeastern Panama.

Barro Colorado Island, C. Z., III, 26 to VI, 6, 1924, (J. C. Bradley,)1♂, 2♀, 15 juv.

MANTIDAE

EREMIAPHILINAE

Mantoida maya Saussure and Zehntner

Barro Colorado Island, C. Z., III, 26 to 31, 1924, (J. C. Bradley), 1♂, [Hebard Cln.].

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[15] Trans. Amer. Ent. Soc., LIV, pp. 168 to 194, pls. 20 and 21.

SCHIZOCEPHALINAE

Angela guianensis Rehn

Barro Colorado Island, C. Z., III, 30, 1924, (J. C. Bradley), 1 ♀, [Hebard Cln.].

OLIGONICINAE

Pseudomiopteryx infuscata Saussure and Zehntner

Barro Colorado Island, C. Z., VI, 25 and VII, 15, 1924, (N. Banks), 2 ♀.

Thrinaconyx fumosus Saussure and Zehntner

Barro Colorado Island, C. Z., VI, 23 to VIII, 1, 1924, (N. Banks), 11 ♂, 14 ♀.

CHOERADODINAE

Choeradodis rhombicollis (Latreille)

It is unfortunate that in Giglio-Tos' monograph, published in 1927, the synonyms *servillei* and *brunneri* were resurrected.

Barro Colorado Island, C. Z., VII, 26, 1930, (J. Zetek), 1 ♀.

MANTINAE

Stagmomantis theophila Rehn

Barro Colorado Island, C. Z., III, 26 to IV, 2, 1924, (J. C. Bradley), 3 ♂.

Tauromantis championi (Saussure and Zehntner)

1894. *Phasmomantis championi* Saussure and Zehntner, Biol. Cent.-Amer., Orth., I, p. 149, pl. 7, fig. 6. [♀; Chiriqui, Panama.]

1925. *Stagmomantis longicollis* Werner, Konowia, IV, p. 164. [♂; Chiriqui, Panama.]

Comparison of two females, one from Juan Vinas in the author's collection, the other from "Costa Rica" in the National Museum, with the above descriptions, gives convincing evidence of the synonymy of Werner's *longicollis*, his description being clearly that of the previously unknown male of *championi*. It is surprising that a student of the Mantidae could have failed to recognize the many striking ambisexual features present in this, one of the largest and most distinctive of the tropical North American Mantidae, particularly when the original description was accompanied by an excellent figure and the type came from the same locality.

Beier has correctly recorded a female from Chiriqui. His comment however that "This striking species, hitherto known only from Panama and Costa Rica, is now also represented from

Colombia," is certainly unfortunate as Chiriqui is the type locality in northern Panama, a region which ceased to be part of Colombia many years ago.

EPAPHRODITINAE

Acanthops falcata Stål

The slightly weaker tuberculation of the pronotum shown by Panamanian material does not warrant the recognition of *griffinii*, a name unfortunately resurrected from the present synonymy by Giglio-Tos in 1927.

Alhajuela, V, 28, 1912, (A. Busck), 1 ♀, [U. S. N. M.]. Barro Colorado Island, C. Z., VII, 1930, (J. Zetek), 2 ♀.

VATINAE

Stagmatoptera septentrionalis Saussure and Zehntner

Barro Colorado Island, C. Z., VII, 26, 1930, (J. Zetek), 1 ♀.

Vates pectinicornis Stål

Barro Colorado Island, C. Z., VII, 16, 1924, (N. Banks), 1 ♀.

Length of body 56.4, length of pronotum 23, length of pronotal shaft 18.7, width of pronotal expansion 6, length of tegmen 40.4, length of cephalic coxa 11.3, length of cephalic femur 14.5 mm.

Phyllovates tripunctata (Burmeister)

Giglio-Tos placed *stolli* (Saussure and Zehntner) in the present synonymy in 1927, under which name we had recorded a male from Gatun in 1923.

Barro Colorado Island, C. Z., VII, 1930, (J. Zetek), 1 ♀.

PHASMIDAE

PSEUDOPHASMINAE

Tenerella tenerrima Redtenbacher

Ancon, C. Z., VIII, 3, 1924, (N. Banks), 1 ♂.

The previously unknown male agrees closely with the originally described female. It has the ocelli arranged in a triangle longer than wide and the occiput caudad ends in a pair of decided convexities flanked by a pair of much smaller but even more prominent longitudinal convexities, separated by fine sulci. The limbs are very pale green, the cephalic femora streaked with brown internally and the last tarsal joints of the caudal limbs alone are blackish.

The apex of the abdomen is little enlarged, the cerci small, the poculum feebly convex, elongate, tapering to its rounded apex and medio-longitudinally carinate, flanked by fingers, bent and curving moderately inward distad, their blunt apices reaching the apex of the subgenital plate. Such processes are known to us elsewhere only in certain species of *Isagoras* Stål.

Length of body 38.5, length of mesonotum 6.7, length of tegmen 3.9, length of wing 21.8, length of caudal femur 8.2 mm.

Pseudophasma menius (Westwood)

Barro Colorado Island, C. Z., V to VI, 1930, (J. Zetek), 1 ♀.

This specimen has the anterior fields of the tegmina greenish white suffused and longitudinally irregularly maculate with dark brown. It is certainly merely a color phase of this usually more uniformly colored species.

Metriotes diocles Westwood

Barro Colorado Island, C. Z., V, 11, 1928, (J. Zetek), 1 ♀.

HETERONEMIINAE

PSEUDOBACTERIA Saussure

In 1904 Kirby selected *Bacteria antillarum* Saussure as genotype (*Bacteria crudelis* Westwood was not originally included) placing it as a synonym of *crudelis*. Brunner considered that species congeneric with *bifrons* Stål, selected as genotype of *Dyme* by Rehn in 1904. Without material of these species we are not convinced that this association is correct, but if such is the case *Dyme* will fall as a synonym of *Pseudobacteria* and not *Bostra* Stål (with *Bacteria turgida* Westwood indicated as genotype by Stål).

Dyme magnifica new species (Pl. VI, figs. 7 and 8)

The male of this species is distinguished by its great size, extremely elongate and slender limbs, short rounded head (suggesting the type usual in *Bacteria* Latreille), glabrous and almost smooth surface, very short median segment, apex of abdomen hardly widened, weakly curved cerci projecting much beyond ultimate tergite, small and simple poculum and rich black, very deep and rich green, orange yellow, buff and red brown coloration.

The genitalia agree in type with Costa Rican specimens of *D. discors* Brunner and are very distinct from those of the other species before us assigned to the present genus. That species is however widely distinct in the much longer head and numerous other features.

Type.—♂; Changuinola District, Bocas del Toro, Panama. May 21, 1924. (J. C. Bradley.) [Hebard Collection, Type No. 1231.]

Size extremely large, very much larger than in any other Central American species assigned to the genus, form very slender. Surface smooth and glabrous, mesonotum with a few almost obsolete tubercles. Head short, dorsal length no greater than width across eyes, cheeks and occiput smooth, convex. Eye two-thirds as long as cheek. Interocular area slightly impressed latero-proximad and strongly so distad. Antennae exceedingly elongate, longer than body. Pronotum twice as long as wide, smooth, with longitudinal and transverse sulci distinct. Mesonotum very elongate, but decidedly shorter than cephalic femur. Median segment only slightly longer than its caudal width. Abdominal tergites elongate and slender, enlarged at their junctures; seventh two-fifths as long as sixth, widening weakly caudad; eighth dorsad slightly shorter, with parallel sides, laterad as long with ventral margin straight and ventro-caudal angle well rounded, distinctly less than a rightangle; ninth (ultimate tergite) shorter than eighth in even greater ratio, no longer than broad, surface moderately convex laterad, with a short distal medio-longitudinal carina, laterad with margins obtuse-angulate produced, distad rectangulate-emarginate between blunt apices. Poculum low, becoming more convex-produced meso-distad, thence tapering to the rounded (apparently briefly incised) apex, projecting as far as the dorso-distal margin of the eighth tergite. Cerci moderately stout, moderately elongate, curved very slightly inward, with apices slightly enlarged, rounded but appreciably obliquely truncate on their inner surfaces.

Head light orange yellow, palpi, interocular impression and post-ocular and a medio-longitudinal dorsal band of blackish brown. Antennae black. Pronotum and adjacent portions of cephalic limbs to beyond their curvature cossack green, these limbs thence blackish but tarsi paler, the metatarsi marbled with ochraceous buff. Mesothorax and metathorax ochraceous tawny, but cossack green at bases of limbs; median and caudal femora cossack green, their tips and the tibiae blackish brown, the latter with three very broad buffy annuli of which the first is very conspicuous, the second suffused and the third only suggested, tarsi blackish brown. Median segment greenish becoming ochraceous tawny proximad. Abdomen liver brown, apex blackish brown marbled with buff, the eighth tergite with broad ventro-lateral section and ninth tergite in adjacent proximal portion warm buff.

Length of body 142, head 4, mesonotum 38.2, metanotum (including median segment) 26, median segment 3.8, cephalic femur 50.7, cephalic tibia 67.8, median femur 46.4, caudal femur 52.2; width of head across eyes 4, mesonotum (least) 1.9, eighth abdominal tergite caudad (greatest) 2.4 mm.

Oncotophasma martini (Griffini)

Barro Colorado Island, C. Z., VI, 1930, (J. Zetek), 1 ♀ (green); VII, 17, 1924, (N. Banks), 1 ♀ (brown).

These, the first known females, differ very widely in appearance from the males (which have a trivittate head and metanotum remarkably and suddenly swollen in caudal half). The coloration is uniform. The hirsute mesonotum (more distinctly and generally cephalad) and metanotum show subobsolete tubercles and rugae laterad, the latter being unspecialized. Contrary to Brunner's key the sharp subrectangulate apex of the operculum does not reach as far as the middle of the ninth tergite, but the filiform apices of the ovipositor, recurved distad, reach almost to its apex. The femora have the genicular lobes of all but the internal of the cephalic spined, but much more weakly than in the male. The cephalic femora are decidedly more lamellate. The median femora have six to nine ventro-internal, the caudal six to ten ventro-internal small spines (in the male decidedly variable in number particularly on the median femora, there elongate and very elongate on the caudal femora). The caudal tibiae are also armed with a row of decidedly smaller dorsal spines.

Our specimen measures as follows; length of body 89.2, length of mesonotum 21.3, length of metanotum (including median segment) 13.2, length of median segment 4, length of cephalic femur 20.7, length of caudal femur 19.8, length of operculum 7.3 mm.

To this genus *Bostra podagrica* Stål was transferred by Kirby in 1904. It was placed in *Dyme* by Brunner in 1908, which action we followed when listing the species of Panama in 1923. We believe that that species and the Colombian *Dyme coxata* Brunner probably represent a generic unit between *Oncotophasma* Rehn and *Dyme* Stål.

ACRIDIDAE

ACRYDINAE

Platytettix harroweri Hebard

Barro Colorado Island, C. Z., VII, 17 to 24, 1924, (N. Banks), 1♂, 4♀, 1 juv. ♂.

The male, here selected as allotype, agrees unusually closely with the female in all ambisexual features. It is smaller with pronotum slightly more abbreviate.

Chiriquia serrata Morse

Changuinola District, Bocas del Toro, V, 21, 1924, (J. C. Bradley), 1 juv. ♀.

In this species the disto-lateral projections of the fastigium beside the eyes are stronger in immatures than in adults.

Paratettix antennatus Hebard

Barro Colorado Island, C. Z., VI, 6, 1 ♀, [Hebard Cln.].

Paratettix frey-gessneri Bolivar

Chiriqui Grande, IV, 15 and 16, 1 ♀, [Hebard Cln.].

EUMASTACINAE

The Surdus Group of the Genus Eumastax Burr

This group is distinguished by having as the outstanding feature of coloration the caudal femora red in distal half as far as the genicular areas. The first species described was *surdus* Burr, based on a female from (probably the western valleys on] the slopes of the Volcano of) Chiriqui, Panama. We now know that a number of species exist, found from Honduras to the Chaco in northwestern Colombia, all apparently decidedly local in distribution. The striking features of differentiation are found in the male genitalia (except in *carrikeri*, where the female subgenital plate is also distinctive) and until males from northwestern Panama are secured *surdus* can not be adequately characterized. From our knowledge of the distribution of at least eight species of the group, however, there is little probability that any of the species either from central Costa Rica or the Canal Zone represent *surdus*.

The most important differences in these species are found in different organs. Highest specialization in the supra-anal plate is found in *veraguae* here described, in the cerci in the Panamanian *cerciatus* Hebard,[16] in the subgenital plate and preceding tergite in *carrikeri* Hebard of the Colombian Choco (in which species the red markings of the caudal femora do not reach distad as far as in the others). The form and size of the subgenital plate (compared with the preceding sternite), however, is found in these and other undescribed species to show differentiation between the largest number of species.

Eumastax veraguae new species (Pl VI, figs. 9 and 10)

The unique type was recorded by us as *surdus* in 1924, at which time we had no idea that the species of this group were so numerous and so local. The large immature female from Gatun, then referred to *cerciata*, we now realize quite probably represents *veraguae* instead.

This is apparently a smaller species than *cerciatus*, but generally very similar except that the male supra-anal plate is very greatly constricted, the cerci are simple and the abdominal apex is scarcely enlarged, the comparatively small subgenital plate with dorsal margins almost straight and horizontal to the acute apex.

Type.—♂; Guamina, Chagres River, Panama. March 5, 1922. (G. H. H. Tate.) [Hebard Collection, Type No. 1232.]

Size small, form medium for this genus of small and slender species, smaller than *cerciatus*. Vertex, frontal costa, pronotum (except that its caudal margin is very broadly convex, showing no angulation) and caudal metatarsus as described for *cerciatus*.[17] Tegmina and wings fully developed, hyaline, extending slightly beyond apex of abdomen which is only slightly thickened. Ninth tergite not enlarged, with a large concave median area, there briefly produced with short lateral margins straight convergent to the narrow base of the supra-anal plate; the latter elongate shield-shaped, its lateral margins faintly diverging, then weakly convex convergent to the acute apex, its basal (least) width contained fully twice in its length, its dorsal surface irregularly concave. Cercus short, almost straight (very faintly incurved), simple, cylindrical, tapering feebly to the blunt apex; length equal to ventral length of eighth sternite. The latter moderately larger than seventh sternite, considerably shorter than subgenital plate. Subgenital plate comparatively small, convex, with a medio-longitudinal carina; free lateral margins horizontal, almost straight, very faintly convex to the acute apex, which in lateral aspect is subrectangulate.

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[16] The females originally assigned to this species from Gatun and the Colombian Choco agree, but we now know can not be safely assigned without males from those regions.

[17] Trans. Amer. Ent. Soc., XLIX, p. 178, (1923).

General coloration light yellow ocher. Face and two proximal antennal joints whitish, genae dirty whitish, occiput blackish. Remaining antennal joints prouts brown. Tegmina and wings transparent, very faintly suffused, with blackish veins. Caudal femora with carinae of enlarged portion in all but proximal section black, these femora light nopal red in distal two-fifths but with apices blackish with dorso-external surfaces whitish. Caudal tibiae yellowish suffused with blackish, such suffusion weak distad and leaving a distinct meso-proximal annulus also. Apex of abdomen suffused, brown.

Length of body (abdomen extruded) 13, length of pronotum 1.9, length of tegmen 10.2, distal (greatest) width of tegmen 1.7, length of caudal femur 10 mm.

ACRIDINAE

Orphulina balloui (Rhen)

Bella Vista, Panama City, VII, 6, 1924, (N. Banks), 1 ♀. Ancon, C. Z., III, 20, 1920, 1 ♂, [Cornell Univ.]; VIII, 6 to 8, 1924, (N. Banks) 1 ♂, 2 ♀.

Orphulella concinnula (Walker)

Barro Colorado Island, C. Z., VI and VIII, 19, 1930, (J. Zetek), 1 ♂, 1 ♀. Ft. Davis, VII, 5, 1924, (N. Banks), 5 ♂, 1 ♀. La Sabana, between Panama City and Old Panama, VII, 7, 1924, (N. Banks), 1 ♂.

Orphulella punctata (DeGeer)

Barro Colorado Island, C. Z., VI, 18 to VIII, 19, 1930, (J. Zetek), 16 ♂, 14 ♀, 7 juv., (green phase predominant). Ancon, C. Z., III, 20, 1920, 1 ♂, [Cornell Univ.].

OEDIPODINAE

Heliastus venezuelae Saussure

Bocas del Toro, VII, 1 to 10, 1908, (Wirt-Robinson), 1 ♂, [U. S. N. M.]. La Chorrera, V, 22, 1912, (A. Busck), 1 ♂, [U. S. N. M.]. Alhajuela, III, 11, 1912, (A. Busck), 1 large juv. ♀, [U. S. N. M.]. Panama City, VII, 1915, (D. E. Harrower), 1 ♂, [A. N. S. P.]. Culebra Cut, C. Z., XI, 14, 1913, (M. Hebard; scarce on bare soil of excavations), 1 ♂, 1 ♀, 1 large juv. ♀, [Hebard Cln]. Gatun, C. Z., VI to VIII, 22, 1915 and 1916, (D. E. Harrower), 3 ♂, 1 ♀, 1 large juv. ♀, [Hebard Cln.].

CYRTACANTHACRINAE

Argiacris tricristata (Serville)

Barro Colorado Island, C. Z., VI, 18, 1930, 1 small juv. ♀; VII, 1930, 1 ♀, (both J. Zetek).

Xyleus rosulentus (Stål)

Barro Colorado Island, C. Z., VI, 1930, (J. Zetek), 1 ♂.

Caudell in recording material from this locality in 1932 has pointed out that *Xyleus* must take the place of *Diedronotus*.

Chromacris psittacus (Gerstaecker)

Changuinola District, Bocas del Toro, V, 21 and 25, 1925, (J. C. Bradley), 2 ♂, 1 ♀ (wings orange). Barro Colorado Island, C. Z., VII, 1930, (J. Zetek), 1 ♀ (wings orange).

Tropidacris latreillei (Perty)

Barro Colorado Island, C. Z., IV, 1925, (J. C. Bradley), 1 ♂. Pearl Islands, Gulf of Panama, 1928, (T. H. Whitcroft), 1 ♀, [Hebard Cln.].

Legua crenulata (Stoll)

Barro Colorado Island, C. Z., VII, 1930, (J. Zetek), 1 ♂.

Leptysma insularis (Bruner)

Ancon, C. Z., VIII, 8, 1924, (N. Banks), 1 ♀.

Opshomala goethalsi Hebard

Barro Colorado Island, C. Z., VII, 3, 1930, (J. Zetek), 1 ♀. Ancon, C. Z., III, 1920, 1 ♂, [Cornell Univ.].

Though subject to decided size variation, this species in Panama averages larger and more robust than *O. cylindrodes* (Stål). We believe that this Barro Colorado Island female represents *goethalsi* and that Caudell's female from the same locality recorded in 1932 probably also represents this species.

Inusia chipmani chipmani Bruner

Barro Colorado Island, C. Z., VIII, 19, 1930, (J. Zetek), 1 juv. ♂.

Oxyblepta limbatipennis Stål

Barro Colorado Island, C. Z., VI, 1930, (J. Zetek), 1 ♂.

Poecilocloeus rhabdotus Hebard

Barro Colorado Island, C. Z., VI, 22 and 23, 1924, (N. Banks), 1 ♂, 1 ♀.

This, the first known male, is designated allotype. It closely resembles the female but is smaller, with antennae longer and organs of flight proportionately less reduced. Small triangular well separated furcula are present just within the margins of the roughly quadrate supra-anal plate, which is nearly twice as broad as long, with lateral margins parallel then very feebly convergent and apex transverse, showing a low blunt angulate production mesad. The cerci are very broad at base, with dorsal margin strongly convex then concave declivent, the shaft stout, slightly curved dorsad, of almost equal width to the very slightly enlarged rounded truncate apex. The erect pallium is decidedly elevated, projecting slenderly a distance slightly less than the cercal length, The subgenital plate is convex, but impressed and concave dorsad near the free margin on each side with blunt conical (not elevated) apex between.

Length of body 21, length of pronotum 3.9, length of tegmen 15, length of caudal femur 12.1 mm.

Leioscapheus gracilicornis Bruner

Barro Colorado Island, C. Z., VII, 15, 1924, (N. Banks), 1 ♀.

Ampelophilus olivaceus (Giglio-Tos)

Ancon, C. Z., VIII, 6 and 8, 1924, (N. Banks), 1 ♂, 2 ♀.

The previously unknown male agrees fully with *A. meridionalis* (Bruner) in genital characters. It is separated by the decidedly smaller, decidedly separated tegminal pads and the entire apical portion of the subgenital plate is dark brown (only the immediate apex being light brown in *meridionalis*).

Coscineuta coxalis (Serville)

Ancon C. Z., (W. M. Wheeler; on *Cordia gerascanthus*), 2 ♀, [Hebard Cln. and Cornell Univ.]. Pinogana, Darien, XII, 1915, (Munoz), 1 ♀, [Hebard Cln.].

Phaeoparia rotundata Stål

Barro Colorado Island, C. Z., VII, 26, 1930, (J. Zetek), 1 ♂, [Cornell Univ.].

Osmilia flavolineata (DeGeer)

Changuinola District, Bocas del Toro, III, 1924, (J. C. Bradley), 1 ♂. Barro Colorado Island, C. Z., IV, 2, 1924, (J. C. Bradley), 1 ♀ ; VI to VIII, 19, 1930, (J. Zetek), 3 ♂, 14 ♀. Ancon, C. Z., III, 20, 1930, 3 ♂, 3 ♀, [Cornell Univ.]; (W. M. Wheeler), 1 ♂, 1 ♀, [Hebard Cln.].

Schistocerca impleta (Walker)

Ancon, C. Z., III, 1920, 1 ♂, 1 ♀, [Cornell Univ.].

This insect, so recorded by us in 1924, is a widespread, common and variable species in Costa Rica and Panama. The type from "The West Coast of America" must be studied before the name can be applied with certainty.

If correctly assigned here, we are now satisfied that the Mexican insect which we have recorded as races of *vitticeps* will have, instead, to be referred to races of the older *impleta*, as all represent no more than poorly defined races of a single species.

Schistocerca paranensis (Burmeister)

Pearl Islands, Gulf of Panama, 1928, (T. H. Whitcroft), 1 ♀ (large, sedentary phase), [Hebard Cln.].

Aidemona azteca Saussure

Barro Colorado Island, C. Z , VI, 1930, (J. Zetek), 1 ♀.

TETTIGONIIDAE

PHANEROPTERINAE

Dolichocercus latipennis (Brunner)

Barro Colorado Island, C. Z., VI, 1930, (J. Zetek), 1 ♂.

This is the third specimen of this very remarkable Panamanian species to be recorded.

Scudderia paronae Griffini

Barro Colorado Island, C. Z., VII, 1930, (J. Zetek), 1 ♀.

We referred this species to *Phaneroptera* in recording a Panamanian series in 1927.

Chloroscirtus discocercus Rehn

Barro Colorado Island, C. Z., VI and VII, 3, 1930, (J. Zetek), 1 ♂ ,1 ♀.

Females of this genus are extremely difficult to separate, the present measures; length of body 19, length of pronotum 6.2, length of tegmen 37.8, greatest tegminal width 8.8, length of caudal femur 21.9, length of ovipositor 5.8, median depth of ovipositor 2.5 mm.

Orophus tessellatus Saussure

Changuinola District, Bocas del Toro, V, 19 and 21, 1924, (J. C. Bradley), 1 ♂, 1 ♀ (large, brown). Bocas del Toro, IV, 1924, (J. C. Bradley), 2 ♂, (small, green).

Montezumina oblongoculata mesembrina Hebard

Barro Colorado Island, C. Z., VII, 1930, (J. Zetek), 1♂, 1♀.

Anaulacomera furcata Brunner

Barro Colorado Island, C. Z., VI, 27, 1930, (J. Zetek), 1♀. Ancon, C. Z., III, 1930, 1♀, [Cornell Univ.]. Tapia, near Juan Diaz, on edge of Sabanas, VII, 1923, (Chapin and Rogers), 1♂, [Davis Cln.].

Anaulacomera alfaroi Rehn

Barro Colorado Island, C. Z., VI, 1930, (J. Zetek), 1♀.

Anaulacomera uncinata Hebard

Barro Colorado Island, C. Z., VI, 27, 1930, (J. Zetek), 1♀.

This specimen agrees completely with the allotype. We can not help wondering whether the larger size, particularly of the tegmina, may indicate that these females represent a species related to but larger than *uncinata*, of which the male is still unknown.

Proviadana lita Hebard

Barro Colorado Island, C. Z., IV, 2, 1924, (J. C. Bradley), 1♀, [Hebard Cln].

This specimen was recently recorded with the description of the female type from Colombia.

Viadana zetterstedti (Stål)

Barro Colorado Island, C. Z., (J. Zetek), 1♂.

Immersion in some liquid has given this specimen a somewhat glabrous, unnatural appearance.

Microcentrum philammon Rehn

Ancon, C. Z., III, 20, 1930, 1♂, 1♀, [Cornell Univ.].

This species is a member of the Lanceolatum Group, which developes many distinctive species in South America and which is widely divergent from the genotype of *Microcentrum*. In appearance *Philophyllia* Stål is in some ways suggested.

Microcentrum simplex Hebard

France Field, C. Z., VII, 7, 1920, (M. Hebard; from forest foliage in low wet area at night), 1♀, [Hebard Cln.].

Recorded as *Microcentrum* sp. by us in 1927, we recorded this specimen in our original treatment of *simplex* in 1932, a species known northward to the state of Vera Cruz, Mexico.

Microcentrum veraguae new species (Pl. VII, figs. 1, 2 and 3)

This is the species three males of which we recorded as *M. concisum* Brunner in 1927 from La Chorrera, Rio Trinidad and "Panama."[18]

Colombian specimens of *concisum* now before us show that insect, though generally similar, to be separated readily by the pronotum being very finely impresso-punctulate (this weakest dorso-cephalad) and the male cercus with apical tooth as broad as long with its dorso-distal angle acute but its ventro-distal angle rounded (Pl. VII, figs. 4 and 5). In addition the tegmina are appreciably broader with apex more broadly rounded and are very slightly less glabrous.

The Concisum Group is distinguished by the very broad fastigium which is not or very feebly sulcate, the pronotum with a distinct angulate production of the cephalic margin, the comparatively broad tegmina and slightly deeper than usual, rich, uniform green coloration.

Type.—♂; Trinidad River, Panama. March 22, 1912. (A. Busck.) [Hebard Collection, Type No. 1233.]

Size small and form robust for the genus. Head with fastigium very broad, with lateral margins little convergent, at juncture with facial fastigium considerably over twice the width of the proximal antennal joint (as in this sex of *concisum*, in females of which species this dimension is fully three times), surface with a very fine medio-longitudinal sulcus indicated (obsolete to very weak in *concisum*). Lateral ocelli large. Pronotum smooth; a short distinct transverse sulcus present latero-cephalad cutting lateral margins of disk; cephalic margin of latter with a rounded obtuse-angulate median production; lateral lobes very deep, humeral sinus deep. Tegmina distinctly widest just beyond apex of anal field, narrowing thence to the broadly rounded apex (which is not as broad as in *concisum*); stridulating vein very elongate and very strongly longitudinally sulcate; median vein sinuous with first branch running to ulnar vein, second branch running to very near that vein and there connected with it by a very short vein (in paratype there briefly in contact with ulnar vein), last branch running to sutural margin; veins at costal margin not thickened. Wings well surpassing tegmina. Ultimate tergite truncate. Supra-anal plate elongate. Cerci elongate, tapering, curved faintly inward, this becoming stronger distad; apices not enlarged, rounded, armed dorso-externally with a small claw-like tooth over twice as long as its basal width, its acute apex reaching as far as termination of shaft. Subgenital plate distad with lateral very weakly convergent rounded carinae and a medio-longitudinal carina which disappears distad; styles in simple sockets, straight, simple, approximately four times (approximately three times in paratype) as long as broad, interval between them feebly concave and about half as long as the style.

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[18] A male recently recorded by us as *M. concisum* (Trans. Amer. Ent. Soc., LVIII, p. 325, (1932)) from San Isabel, Chiapas, Mexico, represents still another as yet undescribed, species of the Concisum Group.

General coloration deep turtle green, feebly glabrous (body and limbs often buffy from drying.) Male stridulating area immaculate. Cephalic tibiae at auditory foramina buffy suffused with brown and entire dorso-caudal surface above caudal foramina blackish brown (such is indicated to a decidedly less degree in *concisum*).

The male from La Chorrera, Panama, taken May 9, 1912 by A. Busck is designated a paratype, and belongs to the United States National Museum. The measurements of a very small male from Eden, Nicaragua, taken May 18, 1922, by W. Huber and belonging to the Academy follow those of the type. Length of body 22.6 and 18.7, length of pronotum 5.9 and 5.1, caudal width of pronotum 5.6 and 4.9, length of tegmen 37.7 and 32.7. greatest width of tegmen 13 and 11.1, length of caudal femur 16.3 and 15.7 mm.

Lamprophyllum micans Hebard

Barro Colorado Island, C Z., VI, 18 and VII, 1930, (J. Zetek), 2♂.

Philophyllia ingens new species (Pl. VII, fig. 6)

This species, without the female being known, can be assigned to *Philophyllia* through its great size, general form, pale subocular band, very deep pronotal lateral lobes with ventral margins showing definite concavity in cephalic half and male cerci very slender and not at all enlarged distad.

The vertex not or scarcely sulcate and veins terminating in nodes along the costal margin of the tegmina suggest instead the Lanceolatum Group of the genus *Microcentrum* Scudder.

It differs widely from *P. guttulata* Stål in the latter feature, its larger size, broader tegmina which narrow more gradually distad, coarse (instead of minute) tooth surmounting the male cercal apex, normally unarmed ventro-cephalic margin of cephalic femora (in two specimens one has one minute tooth distad and the other two such on one limb only) and strikingly black spines of the ventral margins of the caudal femora.

Type.—♂; Eden, Pis Pis Mining District, Nicaragua. May 30, 1922. (W. Huber.) [Acad. Nat. Sci. Phila., Type No. 5520.]

Size largest of the known species of the genus, organs of flight very ample. Fastigium small, rounded declivent, sulcus obsolete (occasionally feebly indicated), sides not convergent to juncture with facial fastigium where the vertex is twice the dorsal width of the first antennal joint. Head glabrous, a weak broad vertical sulcus from eyes to extremity of clypeal suture. Pronotum smooth, weakly glabrous, disk with rounded lateral carinae moderately convergent and disappearing cephalad, cephalic margin of disk with a mere trace of angulate convexity, caudal margin convex with a merest trace of angulation; lateral lobes very deep with ventral margins truncate, feebly convex caudad and feebly concave cephalad, humeral sinus decided. Tegmina broadening in less than cephalic third, thence gradually narrowing to the broadly rounded apices; stridulating veins comparatively short and not prominent; median vein forking before middle, branches more nearly longitudinal than in *guttulata*, discoidal vein with one prominent and one small branch both running to apex of tegmen. Wings decidedly surpassing tegmina. Ultimate tergite truncate. Supra-anal plate triangular, as long as basal width. Cercus elongate, tapering to slender apex formed by a black chitinous blade no wider than the shaft, its dorsal more triangularly produced than its ventral angle. Subgenital plate ample, disto-laterad with convergent carinae gradually increasing to form slightly produced sockets for the small simple styles; the latter slightly over twice as long as broad, separated by a moderately concave interval in length slightly less that of one of the styles. Femora with genicular lobes bispinose, of the cephalic and median very minutely so; ventro-cephalic margins of cephalic (normally) unarmed, of median with (1 to 4) minute spines, of caudal with numerous minute spines.

General coloration shining rich green, face paler with a band of buff yellow running obliquely ventro-caudad from base of eye, flanked caudad by whitish (often discolored in dried specimens). Tegmina with sutural margins alone very finely shining blackish brown. Antennae with first joint greenish, thence tawny becoming blackish distad. Spines of ventral margins of femora strikingly black though very small, of tibiae tawny.

♂	Length of body	Length of pronotum	Caudal width of pronotum	Length of tegmen	Width of tegmen	Length of caudal femur
Eden, Nicaragua. *Type*	38.7	9.6	7.	64.	17.3	35.
Eden. Nicaragua. *Paratype*	36.	9.6	7.	63.	17.1	33.4
La Florida, Costa Rica	36.	9.2		65.	17.2	32.2
Pozo Azul, Costa Rica	47.[19]	11.	8.	73.7	20.8	36.4
Bocas del Toro, Panama	36.8	9.3		63.8	17.8	32.8

Specimens Examined 8; 8 males.

Eden, Pis Pis District, Nicaragua, V, 1 and 30, 1922, (W. Huber), 2♂ *type*, and *paratype*; VI to VII and IX, 1922, (T. W. Bouchelle), 2♂ *paratypes*, [A N. S. P.]. Great Falls, Pis Pis District, Nicaragua, IV, 23, 1922, (W. Huber), 1♂ *paratype*, [A. N. S. P.].

La Florida, Reventazon Valley, Costa Rica, (C. H. Lankester), 1♂, [A. N. S. P.]. Pozo Azul de Pirris, Costa Rica, (C. F. Underwood), 1♀, [Hebard Cln].

Barro Colorado Island, Canal Zone, Panama, VI, 1930, (J. Zetek), 1♂ [Hebard Cln.].

PSEUDOPHYLLINAE

Balboa tibialis (Brunner)

Barro Colorado Island, C. Z , VII, 1930, (J. Zetek), 1♀.

Though in other respects perfectly normal in coloration (brown with smear of shining blackish brown on tegmina weaker than in males), the cerci are turtle green (very pale olivaceous).

Leptotettix giglio-tosi Griffini

Barro Colorado Island, C. Z., (J. Zetek), 1♀.

Idiarthron major Hebard

Barro Colorado Island, C. Z., VII, 1930, (J. Zetek), 1♂.

Though slightly larger and showing marked difference in the male genitalia, this specimen agrees so fully in all other features with the type of *major* that specific separation is impossible. Indeed Saussure and Pictet have already stated that singular individual variation occurs in the shape of the anal pieces of the males of *Idiarthron*.

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[19] Abdomen extruded.

In the present specimen the supra-anal plate has its apex produced on each side in a conical projection twice as long as its basal width and the intervening area is triangularly produced nearly half as far.

Length of body 35, length of pronotum 9.1, caudal width of pronotal disk 5.2, length of tegmen 40, greatest tegminal width 8.4, length of caudal femur 27 mm.

Idiarthron incurvum (Stål)

Boquete, Chiriqui, VIII, 15 to 20, 1922, (D. E Harrower), 1 juv. ♂, [A. N. S. P.]

Like in adults the supra-anal plate is distinctively decurved in this immature.

Ischnomela pulchripennis Rehn

Barro Colorado Island, C. Z , VI, 1930, (J. Zetek), 1♂.

This specimen of this apparently decidedly rare insect is much larger and more richly colored than the type, but shows all the striking distinctive markings except that even traces of femoral annuli are absent.

Length of body 37.8, length of pronotum 9.8, length of tegmen 46, greatest tegminal width 8.8, length of caudal femur 35 mm.

Xestoptera cornea Brunner

Barro Colorado Island, C. Z., VI, 1930, (J. Zetek), 1♂.

This specimen agrees very fully in size, structure and color with the male recorded by us from this locality in 1927. The wings are seen to be weakly tinged with light pink distad, paling gradually proximad from that area.

COPIPHORINAE

Neoconocephalus affinis affinis (Beauvois)

Bocas del Toro, IV, 1924, (J. C. Bradley), 1 ♀ (green). Barro Colorado Island, C. Z., VI, 18 to VII, 1930, (J. Zetek), 3 ♀, 1 juv. ♀ (green).

Neoconocephalus maxillosus (Fabricius)

Barro Colorado Island, C. Z., VII, 1930, 1♂ (brown); VIII, 19, 1930, 1 juv. ♂ (brown), (both J. Zetek).

Copiphora brevirostris Stål

Barro Colorado Island, C. Z., VII, 1930, (J. Zetek), 1♂.

CONOCEPHALINAE

Conocephalus angustifrons (Redtenbacher)

Barro Colorado Island, C. Z., VI, 18, 1930, 1 ♀ (dark, caudate); VIII, 19, 1930, 1 very small juv., (both J. Zetek).

Conocephalus saltator (Saussure)

Barro Colorado Island, C. Z., VII, 1930, (J. Zetek), 1 ♀ (brachypterous).

LISTROSCELINAE

Phlugis teres (DeGeer)

Barro Colorado Island, C. Z., VIII, 19, 1930, (J. Zetek), 1 ♀. Ancon, C. Z., III, 1920, 1 ♂, [Cornell Univ.].

GRYLLACRINAE

Gryllacris panamensis Kirby

Barro Colorado Island, C. Z., VI, 18, 1930, (J. Zetek), 1 large juv. ♂.

This specimen, like the immature female from Frijoles recorded by us in 1927, lacks dark facial markings. It shows more pink, particularly dorso-distad on the abdomen and the caudal tibiae are rich pink to near their apices.

GRYLLIDAE

GRYLLINAE

Miogryllus verticalis (Serville)

Taboga Island, VIII, 11, 1929, (H. A. Pilsbry), 1 ♀, [A. N. S. P.].

This is the large dark megacephalic condition tinged with reddish brown which we have hitherto seen only from the Santa Marta region, Magdalena, Colombia.

Anurogryllus muticus (DeGeer)

Barro Colorado Island, C. Z., VI, 18 to VIII, 19, 1930, (J. Zetek), 2 ♂, 5 ♀ (pair with wings not apparent, others with wings caudate).

The small tympanum of the cephalic face of the cephalic tibiae has disappeared only in the single female with wings not apparent. It is sometimes poorly indicated but is very rarely obsolete in such material.

NEMOBIINAE

Hygronemobius darienicus Hebard

Barro Colorado Island, C Z., VII, 3, 1930, (J. Zetek), 1♂.

This specimen agrees completely in ambisexual characters with the female type from Porto Bello and is designated allotype. It is apterous. The supra-anal plate is vertical, slightly shorter than its basal width, its lateral margins weakly convex-convergent to the broadly rounded apex. The subgenital plate is simple, scoop-shaped, clothed with very minute and very slender elongate hairs.

PHALANGOPSINAE

Luzara minor Hebard

Colon, VI, 1924, (Miss Cheesman), 1♂, [British Mus] Taboga Island, IX, 24, 1924, (Miss Cheesman), 1♂, [Hebard Cln].

OECANTHINAE

Oecanthus californicus Saussure

Chiriqui, 1♂, [Hebard Cln].

This specimen agrees very closely with the description of *O. marcosensis* Baker,[20] except that the proximal joints of the antennae are immaculate (this known to be a feature of individual variation in *californicus*). Baker's name may be a synonym and we are satisfied that at most racial status can be recognized. Additional series will have to be studied before this problem can be decided.

TRIGONIDIINAE

Anaxipha pulicaria (Burmeister)

Changuinola District, Bocas del Toro, IV, 28, 1924, (J. C. Bradley), 1♂ (abbreviate). Barro Colorado Island, C. Z., VII, 3, 1930, (J. Zetek), 1♀ (caudate). XX Plantation, six miles east of Porto Bello, III, 4, 1930, (T. O. Zechokke), 2♂ (brachypterous), [Cal Acad].

Anaxipha stolzmanii (Bolivar)

Barro Colorado Island, C. Z., VI, 18 and VII, 3, 1930, (J. Zetek), 1♂, 1♀ (caudate).

Anaxipha championi (Saussure)

Gatun, C. Z., III, 1930, (T. O. Zechokke), 1♀ (wings briefly projecting), [Cal. Acad.].

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[20] Invertebr. Pacifica, I, p. 81. [[♂]; San Marcos, Nicaragua.]

Anaxipha gracilis (Scudder)

Changuinola District, Bocas del Toro, IV, 21, 1930, (J. C. Bradley), 1 ♀ (caudate, coloration exceptionally intensive). Barro Colorado Island, C. Z., VI, 18 and VII, 3, 1930, (J. Zetek), 4♂, 9 ♀ (caudate). XX Plantation, six miles east of Porto Bello, II, 16, 1930, (T. O. Zechokke), 2♂, [Cal. Acad].

Symphyloxiphus nigrellus Hebard

Changuinola District, Bocas del Toro, IV, 21, 1924, (J. C Bradley), 1 ♀ (brachypterous). XX Plantation, six miles east of Porto Bello, II, 15, 1930, (T. O. Zechokke), 1 ♀, [Cal. Acad.].

Symphyloxiphus pictus (Saussure)

Barro Colorado Island, C. Z., VIII, 19, 1930, (J. Zetek), 1 ♀ (brachypterous). XX Plantation, six miles east of Porto Bello, II, 18, 1930, (T. O. Zechokke), 1♂, 2 ♀, [Cal. Acad.].

ESTRELLINA new genus

This monotypic genus is proposed for *rehni* here described. It is a wide advance from the type found in *Anaxipha* Saussure and even beyond that of *Symphyloxiphus* Rehn, in that both sexes have the tegmina convex and corneous with prominent longitudinal veins, the male entirely lacking a stridulating organ. This agrees with the Philippine *Rhicnogryllus* Chopard, but *fascipes* the genotype[21] is smaller with much shorter limbs, with cephalic tibiae neither enlarged proximad or perforated and the longitudinal tegminal veins are more closely placed (10 or 11 in number).

In its comparatively large size and elongate limbs and ovipositor *Estrellina* shows nearest affinity to the species of the Tolteca Group of *Anaxipha*. These genera agree in the form of the head, shape and prominence of eyes, general pronotal contour and limb and ovipositor characters.

The cephalic tibiae in *Estrellina* are moderately swollen in almost all of cephalic half, a large oval tympanum present on the cephalic face and a very small rounded one on the caudal face. The caudal femora are armed with three pairs of comparatively short, strongly alternating spines and distad with three very small external (of which the median is the longest) and two large internal (of which the dorsal is the longest) spurs. The elongate caudal metatarsus is unarmed except for a pair of very minute dorso-distal spines and a distal spur on each side.

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[21] A series is in the author's collection.

Estrellina rehni[22] new species (Pl. VII, fig. 7)

Few minute crickets are handsomer than this insect, which is pale cinnamon buff with sharply defined blackish brown margins of the pronotum (except caudad) and tegmina, the meso-dorsal area of the latter shining cinnamon brown and a sharply defined dark brown transverse band on each caudal femur.

Type.—♂; Vesta Farm, Estrella Valley, Costa Rica. Elevation 200 feet. September 11, 1923. (J. A. G. Rehn; swept from foliage in dense forest above wet area.) [Acad. Nat. Sci. Phila. Type No. 5521.]

Other characters not given above are the following. Size large, form normal, limbs very elongate (particularly the caudal) when compared with the species of *Anaxipha*. Palpi only moderately elongate, fourth joint considerably shorter than third, fifth slightly longer than fourth, expanding gradually and then more strongly distad to the faintly oblique apex, the apical width nearly one-half the length of the joint. Tegmina reaching base of supra-anal plate, fitting abdomen closely with (a total of 8 or 9) longitudinal veins, their broadly rounded truncate extremities and feebly oblique to the slightly projecting rounded apex at sutural margin. Genitalia simple. Subgenital plate truncate scoop-shaped. Caudal femora extending beyond abdomen three-quarters the length of the body. Caudal tibiae with longest spine slightly shorter than the distance to the next spine.

Allotype.— ♀; same data as type [Acad. Nat. Sci. Phila]

Agrees very closely with male in ambisexual features. Tegmina exactly similar. Ovipositor elongate, moderately curved dorsad, very slightly deeper before apex than eslewhere, apex acute; apical portion with dorsal margin and ventro-lateral margins of dorsal valves very slosely minutely serrulate, ventral margin less closely minutely serrulate, a row of minute nodes distad on sides near dorsal margin.

The data on coloration given above may be augmented as follows. The blackish brown pronotal margins, moderately broad cephalad and broader laterad, are distinctive, with inner margin curving to give the appearance of a horse-shoe. The tegmina at their immediate bases and their marginal fields except dorso-distad are cinnamon buff, the cinnamon brown dorsal area gradually deepening to the blackish brown margins. The band across the caudal femora is warm sepia, decidedly oblique on their inner faces, transverse dorsad and slightly paler and vertically arcuate narrowing ventrad on their external faces. The antennae, palpi, limbs and armament of the latter (except for darker metatarsal spurs and distal tarsal joints) are pale cinnamon buff.

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[22] We name this species in honor of its discoverer, our friend and fellow-worker James A. G. Rehn, whose unfailing energy and interest have been invaluable to us in twenty eight years of closely associated research in the Orthoptera.

The measurements of the Panamanian female follow those of the allotype. Length of body ♂ 5, ♀ 5.2 and 5.7 (somewhat squeezed out); length of pronotum ♂ 1.18, ♀ 1.2 and 1.2; total caudal width of pronotum ♂ 1.17, ♀ 1.4 and 1.49; exposed length of tegmen ♂ 2.84, ♀ 2.98 and 3.05; length of caudal femur ♂ 5.8, ♀ 6.6 and 6.4; length of longest caudal tibial spine ♂ .7, ♀ .71 and .7; length of ovipositor 3 and 3.1 mm.

Specimens Examined: 4; 1 male, 2 females and 1 immature male.

Vesta Farm, Estrella Valley, Costa Rica, 200 feet, IX, 11 and 13, 1923, (J. A. G. Rehn; as given for type), 1♂, 1♀, *type* and *allotype*, 1 juv. ♂, [A. N. S. P.]. Changuinola District, Bocas del Toro, V, 18, 1924, (J. C. Bradley), 1♀, *paratype*, [Hebard Cln.].

Hebardiniella americana (Chopard)

We recorded this species from Barro Colorado Island, Canal Zone, in 1928,[23] at which time we proposed the genus *Chopardina*, with *Metioche americana* Chopard as genotype. That generic name had already been used by Surcouf in 1914, so the present genus has been renamed *Hebardiniella* by Chopard in 1931.[24]

Phylloscyrtus elegans Guerin

XX Plantation, six miles east of Porto Bello, II, 4 to 18, 1930, (T. O. Zechokke), 4♂, 3♀.

ENEOPTERINAE

Ponca venosa Hebard

Changuinola District, Bocas del Toro, V, 19 and 21, 1924, (J. C. Bradley), 2♂. Barro Colorado Island, C. Z., VII, 26, 1930, (J. Zetek), 1♀.

Diatrypa apithoides Saussure

Changuinola District, Bocas del Toro, V, 21, 1924, (J. C. Bradley), 1♂, [Hebard Cln.].

This is the first known male, the female type coming from Bugaba, Panama. It agrees closely with the original description in ambisexual characters. The general coloration is clear cinnamon, the antennae with widely spaced very short annuli of brown which become dedidedly longer and closer distad. The male tegmina have three oblique veins and the tympanum is obliquely transverse with proximal angle rectangulate.

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[23] Trans. Amer. Ent. Soc., LIV, p. 260.

[24] Arkiv for Zool., XXIII A, No. 9, p. 13.

Length of body 8.5, length of pronotum 2.3, caudal width of pronotal disk 2 7, length of tegmen 8, dorsal width of tegminal fields 3.9, projection of wings beyond tegmina .5, length of caudal femur 7.7 mm.

Paroecanthus annulatus (Scudder)

Barro Colorado Island, C. Z., VII, 1930, (J Zetek), 1 juv. ♀.

Paroecanthus podagrosus Saussure

Barro Colorado Island, C. Z., VI, 18 and 27, 1930, (J. Zetek), 2♂.

While this species has a Diatrypoid appearance, *annulatus* has that of a robust Orocharoid.

Aphonomorphus flavifrons (Saussure)

Barro Colorado Island, C. Z , VII, 3, 1930, (J. Zetek), 1 juv. ♀.

The pale interocular bar and heavy blackish brown flecks along the ventro-external margin of the caudal femora distad are as in the female we recorded from France Field, Canal Zone, but the bar on the external face of the caudal femora is much heavier.

MOGOPLISTINAE

Cycloptilum antillarum (Redtenbacher)

Ancon, C. Z., (W. M. Wheeler; in hollow swelling of *Cordia gerascanthus*), 1♀.

GRYLLOTALPINAE

Gryllotalpa hexadactyla Perty

Gatun, C. Z., III, 1930, (T. O. Zechokke), 1♀ (caudate), [Cal. Acad.].

Gryllotalpa intermedia Saussure

XX Plantation, six miles west of Porto Bello, II, 20, 1930, (T. O. Zechokke), 1♀ (caudate), [Hebard Cln.].

RIPIPTERYGINAE

Ripipteryx pulicaria Saussure

Frijoles, C. Z., X, 23, 1918, (J. Zetek), 5♂, 3♀. XX Plantation, six miles east of Porto Bello, II, 6 to 17, 1930, (T. O. Zechokke), 2♂, 2♀, [Cal. Acad.].

EXPLANATION OF PLATES

PLATE VI

Fig. 1.—*Parasparatta panamae* new species. Dorsal view of male ultimate tergite, pygidium and forceps. *Type.* XX Plantation, near Porto Bello, Panama. (× 20)

Fig. 2.—*Parasparatta panamae* new species. Dorsal view of female ultimate tergite, pygidium and forceps. *Allotype.* XX Plantation, near Porto Bello, Panama. (× 20)

Fig. 3.—*Chorisoneura bradleyi* new species. Dorsal view of male. *Type.* Barro Colorado Island, Gatun Lake, Panama. (× 4)

Fig. 4.—*Latiblattella bradleyi* new species. Dorsal view of male pronotum. *Type.* Bocas del Toro, Panama. (× 9)

Fig. 5.—*Chromatonotus quarequae* new species. Dorsal view of male pronotum. *Type.* Barro Colorado Island, Gatun Lake, Panama. (× 9)

Fig. 6.—*Cahita nigripes* new species. Ventral view of distal portion of male abdomen. *Type.* Changuinola District, Bocas del Toro, Panama. (Greatly enlarged.)

Fig. 7.—*Dyme magnifica* new species. Dorsal view of male cercus. *Type.* Changuinola District, Bocas del Toro, Panama. (× 18)

Fig. 8.—*Dyme magnifica* new species. Lateral view of apex of male abdomen. *Type.* Changuinola District, Bocas del Toro, Panama. (× 5)

Fig 9.—*Eumastax veraguae* new species. Dorsal view of ninth tergite and supra-anal plate of male. *Type.* Guamina, Chagres River, Panama. (Very greatly enlarged.)

Fig. 10.—*Eumastax veraguae* new species. Lateral view of distal portion of male abdomen. *Type.* Guamina, Chagres River, Panama. (× 15)

PLATE VII

Fig. 1.—*Microcentrum veraguae* new species. Dorsal view of male cercus. *Type.* Trinidad River, Panama. (× 17).

Fig. 2.—*Microcentrum veraguae* new species. Dorsal view of tooth at apex of male cercus. *Type.* Trinidad River, Panama. (Greatly enlarged.)

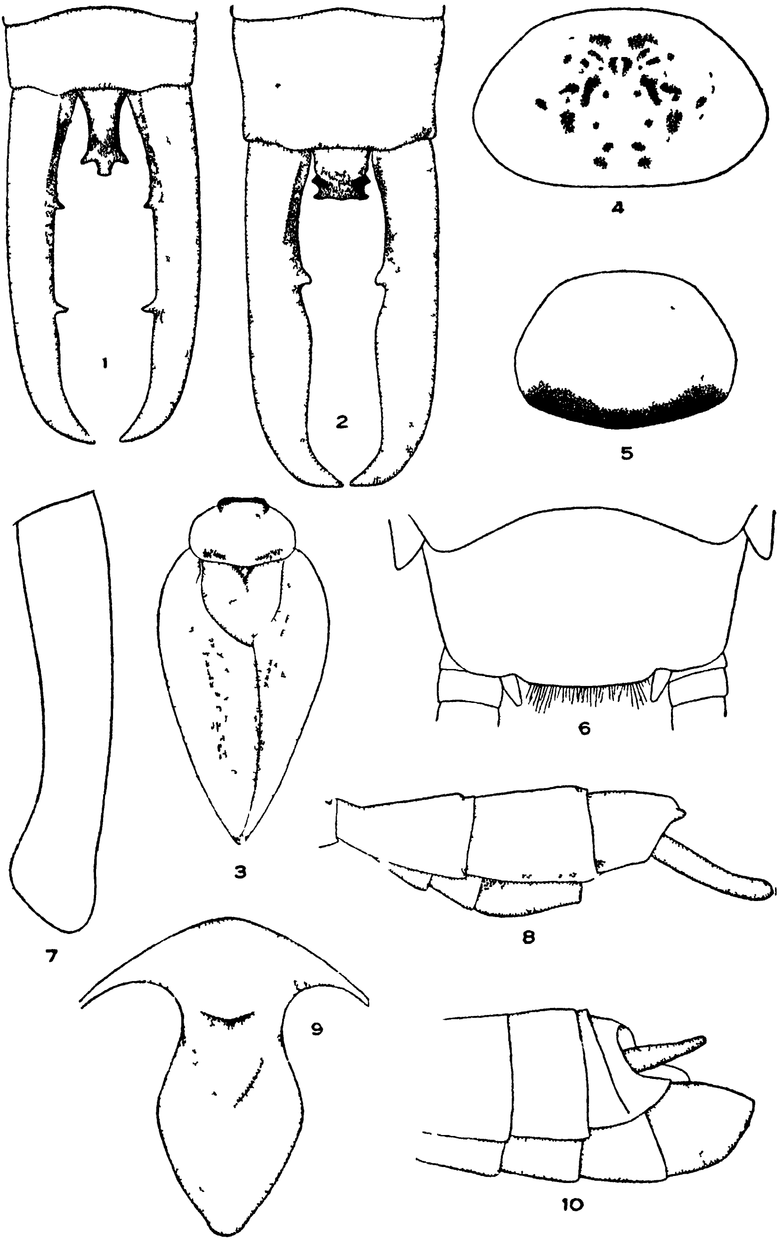
Fig 3.—*Microcentrum veraguae* new species. Ventral view of apex of male subgenital plate and styles. *Type.* Trinidad River, Panama. (× 20)

Fig. 4.—*Microcentrum concisum* Brunner. Dorsal view of male cercus. Hacienda Bolivar, near Santa Marta, Magdalena, Colombia. (× 17)

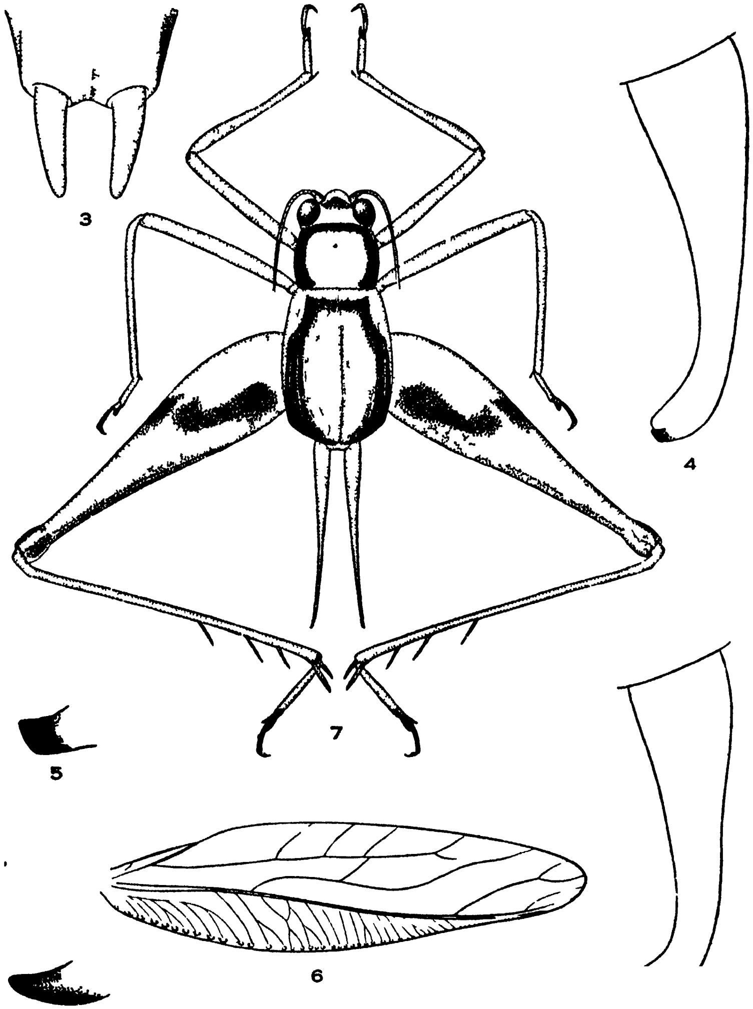
Fig. 5.—*Microcentrum concisum* Brunner. Dorsal view of tooth at apex of male cercus. Hacienda Bolivar, near Santa Marta, Magdalena, Colombia.

Fig. 6.—*Philophyllia ingens* new species. Lateral outline of female tegmen, showing principal veins and marginal specialization. *Type.* Eden, Pis Pis Mining District, Nicaragua. (Natural size.)

Fig. 7.—*Estrellina rehni* new species. Dorsal view of male. *Type.* Vesta Farm, Estrella Valley, Costa Rica. (× 8½)



HEBARD—PANAMANIAN DERMAPTERA AND ORTHOPTERA



HEBARD—PANAMANIAN DERMAPTERA AND ORTHOPTERA

THE MUSCLES AND THE NERVES OF THE OVIPOSITOR OF ANAX JUNIUS[1]

(ODONATA)

BY P. M. DUNCAN

(Plate VIII)

The primary object of this research as suggested to me by Dr. Philip P. Calvert, is "to furnish a description of the muscles and nerves of a well developed ovipositor, such as *Anax junius* possesses, to serve as a basis for determining homologies in other Odonata in which (it has been held) a similar egg-laying organ does not exist."

THE MATERIAL AND ITS PREPARATION

The material studied consisted of two series of serial transverse sections of the eighth, ninth and tenth segments of *Anax junius* female. I am indebted to Dr. Philip P. Calvert for one of these series of transverse sections, made some years ago by Mr. Floyd Lambert, and for two preserved specimens, one of which was used in making the second series of sections. Dr. Calvert also placed at my disposal slides of the gonapophyses and terminal abdominal segments.

There was no record of the thickness of the sections made by Mr. Lambert. The method used to determine their thickness was as follows: The average length of each of the three terminal abdominal segments of both the preserved specimens was determined by direct measurement. The average length of each segment expressed in millimeters was divided by the number of sections that made up the corresponding segment on the slides. The result obtained was the thickness of the average section, approximately 20 microns for each of the three segments concerned.

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[1] A Thesis submitted to the Faculty of the Graduate School, University of Pennsylvania, in partial fulfillment of the requirements for the degree of Master of Arts.

An *Anax junius* female that had been killed in hot water soon after reaching the adult stage and then preserved in 85 per cent alcohol furnished the material for the sections which I made. The abdomen was cut through in the middle of the seventh segment. The terminal part was stained with Delafield's haemotoxylin and alcoholic eosin. The material was infiltrated in a mixture of equal parts of xylol and paraffin for six hours, followed by six hours of infiltration in pure paraffin. The chitin had not become so hard as to make it difficult to obtain sections 10 microns thick.

METHOD OF MEASUREMENT

The two instruments used for measuring the widths of the structures in the transverse sections were the ocular micrometer and the calibrated mechanical stage. The ocular micrometer was employed in the measurement of small structures while the calibrated mechanical stage was reserved for the larger structures.

A hair stretched across the ocular of the microscope served as a cross-hair to be used in conjunction with the millimeter scale on the mechanical stage. Since the widths of the structures were the measurements of interest in the transverse sections, the image of the hair was adjusted until it was perpendicular to the horizontal arm of the mechanical stage. The hair was an ordinate if we consider the horizontal arm of the mechanical stage to be an abscissa. To prove that the ocular cross hair was a true ordinate, some point upon the slide was placed on the image of the cross hair, then the ordinate arm of the mechanical stage only was moved. If the given point continued to remain on the cross hair when the point was moved to the edge of the field, then the image of the cross hair was considered perpendicular to the horizontal arm.

For accurate measurement, it is, of course, essential that the long axis of the transverse sections (in this case the width) is parallel with the horizontal arm of the mechanical stage. In many cases when the slide was placed in the customary position on the mechanical stage, the long axes of the sections were not parallel with the horizontal scale. This difficulty was overcome by turning the slide until the proper conditions were reached.

Readings were obtained by manipulating the slide until the point to be plotted was under the cross hair, then the figures on the horizontal arm indicating the position of the point were recorded. The center line of a section was determined by recording the relative positions on the mechanical stage of the most sinistral and the most dextral points of the section. From these two readings, the position of the center line, being midway between these extremes, could be determined.

The Projection Method

The diagram (Fig. 4) depicts the dorsal aspect of the processes that form the ovipositor and the muscles that insert in the processes. This figure was constructed from the Lambert set of transverse sections of the eighth, ninth and tenth abdominal segments by means of the projection method. This method is similar in theory to the method of constructing whole mount models from models done in wax, or a similar easily workable substance, of transverse sections. By the fitting together of the wax plates representing the transverse sections, large scale tridimensional models may be obtained. The projection method does not give one a whole mount when it is applied to a series of transverse sections but the result is a two dimensional figure in which one of the dimensions was not apparent in the transverse sections. The new dimension has for its basis the thickness of the transverse sections. Here, as in the "wax plate" method, we are fitting the transverse sections together and getting as a result a dimension not apparent in the original transverse sections.

We may either take the dorso-ventral dimension of the transverse section and represent it in our projection while suppressing the dextro-sinistral dimension, or we may suppress the dorso-ventral dimension while depicting the dextro-sinistral dimension, the procedure followed in our figure. In either case, the thickness of the sections is represented by the cephalo-caudal axis in the figure.

The dimension shown in the figure that was present in the original transverse sections is the dextro-sinistral dimension. This was accomplished by taking the greatest width of the structures concerned in the problem, namely, the gonapophyses and their muscles and plotting them according to scale on graph paper. A center line was taken as the base line of these measurements. This line was represented in the transverse sections by a line that divided the section into two mirror images. This center line appears on the projection as the principal axis.

A concrete example will make the explanation clearer. In the 43rd section of the series, the greatest width of the transverse section is 3.5 mm. This would be represented on the graph by two points 3.5 inches apart. The Y axis of the graph bisected the distance between these two points. In the 47th section which is four sections anterior to the last mentioned section, the greatest width of the section is 3.4 mm. This width would be plotted *on the graph as 3.4 inches using the Y axis as a center line.* The second pair of points would be plotted .08 inch cephalad to the first pair. This is according to scale (i.e., 1 inch represented 1 mm. before reduction for publication). For each section is .02 mm. thick and since the points in question are four sections apart, the actual distance between the two sets of points is .08 mm., or the thickness of four sections, which is represented on the graph as .08 inch.

THE GONAPOPHYSES

In this paper, the terms anterior, posterior and lateral gonapophyses are used. For the Odonate ovipositor, these terms seem to be less confusing than any other nomenclature. The term, inner valvulae, used by Walker (1919), is equivalent to the posterior gonapophyses, while his dorsal and ventral valvulae represent the lateral and anterior gonapophyses respectively.

In *Anax junius* the lateral gonapophyses are flattened and form a covering for the other two pairs of gonapophyses that make up the ovipositor proper. On each side the posterior gonapophysis is fitted, for the proximal three-quarters of its length, to the anterior gonapophysis by a ridge and groove joint. The posterior gonapophysis (Figs. 5–7; GP), which is dorsal to the other, furnishes the ridge while the anterior gonapophysis (GA) provides the groove. For the proximal two-fifths of their length, the anterior gonapophyses join at the median line by a ridge and groove joint. In this way the posterior and anterior gonapophyses by their articulations form a tube for the passage of the eggs.

OVIPOSITOR MUSCLES

There are five pairs of muscles and one unpaired muscle attached to the ovipositor. The five pairs are: anterior longitudinal sternal muscles, posterior longitudinal sternal muscles, both of the eighth segment; the inter-gonapophysal muscles; longitudinal sternal muscles of the ninth segment; and the tergosternal genital muscles. The unpaired muscle is the transverse sternal muscle of the ninth segment.

In identifying the ovipositor muscles, I followed the nomenclature used by Whedon in his paper on "The Comparative Morphology and Possible Adaptations of the Abdomen in the Odonata." Whedon names the muscles after their anatomical position, not after their function. This seems to be the more satisfactory method, for homologous muscles, at least in regard to those of the ovipositor, often vary in their functions. For five of the ovipositor muscles I used the names given to them by Whedon. To the ovipositor muscle not mentioned in his paper I have given the name, Inter-gonapophysal.

Du Porte's paper on "The Muscular System of *Gryllus assimilis*" was used as a guide to homologous muscles between the two species. Chopard's book on the last abdominal segments in the Orthoptera was consulted for homologous muscles present in the species which he uses as types.

IN THE EIGHTH SEGMENT

Sterno-gonapophysal.[2]—The Anterior Longitudinal Sternal Muscle (Figs. 4 and 9; LSA) originates in the eighth segment, in the region where the anterior gonapophyses join the sternite. Its origin is similar to that of the posterior longitudinal sternal muscle. Its insertion is along the upper lateral edge of the vagina. It is a thin muscle. Farther cephalad it gives way to bands of muscle encircling the vagina. This ring of muscles is known as the ring muscle of the vagina. The contraction of the anterior longitudinal sternal muscle enlarges the central lumen of the vagina. Chopard mentions a "protracteur inférieur de l'oviscapte," in *Orthacanthacris aegyptia* (Linné) that may be homologous to this muscle in *Anax junius*.[3]

Whedon makes no mention of the Posterior Longitudinal Sternal Muscle (Figs. 4 and 9; LSP) in the eighth segment but this muscle is in the same anatomical position as the longitudinal

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[2] The spelling "gonapophysal" is Du Porte's.

[3] In Chopard's book the main interest lies with the chitinous parts of the abdominal segments. The description of the musculature is not detailed.

sternals of the segments anterior to the eighth. Its origin has already been described in the preceding paragraph. This muscle runs obliquely caudad from its origin to insert on the inner median surface of the anterior gonapophysis. It is a thick muscle. Its action is to retract the anterior gonapophysis.

Tergo-gonapophysal.—Part of the tergo-sternal genital muscle is found in this segment. Since this smaller part in segment eight appears to be continuous with the larger portion in segment nine, we shall describe it under the muscles of that segment.

IN THE NINTH SEGMENT

Sterno-gonapophysal.—The Inter-Gonapophysal Muscle (Figs. 4 and 7; ING) originates on the upper edge of the lateral wall of the lateral gonapophysis. It inserts on the median wall of the posterior gonapophysis. The muscle passes over the portion of the sternite that lies between the lateral and the posterior gonapophyses.

The action of the muscle is to pull the posterior gonapophyses apart from each other. The intergonapophysal muscle is one of the small muscles of the ovipositor.

There is no reference to this muscle in Whedon's paper. I was unable to find a homologous muscle in Du Porte's article on the muscles of the common field cricket. Perhaps a similar muscle in *Pholidoptera femorata* (one of the species used as a type by Chopard and shown in fig. 64, no. 5, of his book) is homologous.

The Transverse Sternal Muscle (Figs. 4, 5 and 6; TRS) is the only unpaired muscle that is found attached to the ovipositor. Its origin is on the sides of the sternite above the pair of Longitudinal Sternal muscles of the ninth segment. It is a thick powerful muscle that pulls the lateral gonapophyses away from each other. If we were naming the muscles by their functions we would call this muscle the Indirect Abductor of the lateral gonapophyses.

This muscle appears in Whedon's fig. 31 of the abdomen of *Anax junius.* There is no homologous muscle in Du Porte's account of *Gryllus assimilis.* Chopard mentions a transverse muscle in *Gryllomorpha dalmatina* (Ocskay) that may be homologous to this muscle.

The Longitudinal Sternal Muscle (Figs. 4, 5 and 6; LS) originates on the ninth sternite above the lateral gonapophyses.

Its insertion is on the thickened ridge of the sternite between the lateral gonapophyses. This is a strong pair of muscles that pulls the lateral gonapophyses together. It is a direct lateral adductor of the lateral gonapophyses.

Muscle 120 in Du Porte's paper is homologous to the longitudinal sternal muscle. Muscle 120, or "The Protractor of the Ovipositor," is described as originating in the process of the supragenital plate (the sternite of the ninth segment) and is inserted into the inner face of the ventral process of the lateral gonapophysis. I have considered the ventral process of the lateral gonapophysis in *Gryllus assimilis* as being homologous to the large ridge mentioned above, which joins the lateral gonapophyses in *Anax junius.*

The "écarteur de la valve supérieure" (Chopard's, fig. 143, no. 1) of *Orthacanthacris aegyptia* (Linné) described by Chopard may be homologous with the longitudinal sternal muscle of *Anax junius.*

Tergo-gonapophysal.—The Tergo-Sternal Genital Muscle (Figs. 4 and 8; TSG), in the two series of transverse sections used as a basis for this work, appeared to be a continuous muscle without a break as it passed from the posterior end of the eighth segment into the anterior end of the ninth segment. For this reason it will be treated as one muscle. This muscle originates on the lateral wall of the eighth and ninth tergites and has its insertion on that part of the eighth and ninth sternites just above the lateral gonapophyses. This is the largest of the ovipositor muscles. Its action is to extend the ovipositor. In Whedon's fig. 31 the tergo-pleural muscles of the ninth segment are laterad of the tergo-sternal genital muscles. In the two series of transverse sections studied in the preparation of this paper, the tergo-pleural muscles are mesad of the tergo-sternal genital muscles. In respect to the general position of these muscles Whedon's fig. is in accord with the results of this paper.

In Du Porte's muscle 112 of *Gryllus assimilis* is found a homologue of the tergo-sternal genital of *Anax junius.* Muscle 112, or "The Second Depressor of the Ovipositor," is in the outer layer of genital muscles of the cricket. It originates from the ento-tergite of the ninth segment and inserts, one part on the ventral process of the lateral gonapophysis and the other part on the median process of the transverse beam connecting the ventral processes of the two lateral gonapophyses.

Muscle 113, "The Third Depressor of the Ovipositor," in the inner layer of genital muscles, might also be considered homologous. Muscle 113 has an origin similar to Muscle 112 and it inserts on the ventral process of the lateral gonapophysis. Muscle 113 lies on the inner side of Muscle 112. The two muscles united would be homologous to the tergo-sternal genital muscle of *Anax junius.*

Three species described by Chopard have muscles that may be homologous to the tergo-sternal genital muscles in *Anax junius.* In *Pholidoptera femorata* (Fieber) and in *Gryllomorpha dalmatina* (Ocskay), the tergo-sternal genital is represented by two pairs of "abaisseurs." The "rétracteur supérieur de l'oviscapte" (Chopard's fig. 143, no. 5) of *Orthacanthacris aegyptia* (Linné) may be homologous with this muscle.

NERVES

The ganglion (Figs. 3, 4 and 10; G) and nerves shown in fig. 3 were studied from the Lambert series of sections and controlled by a dissection of the nerves. The specimen from which my slides were made was not fresh material, hence not favorable histologically. The same procedure of measurement and projection was used as in the case of the muscles. Only the nerves arising from the terminal abdominal ganglion (Figs. 3, 4 and 10; G) that send branches into the ovipositor muscles are shown in the diagram. To avoid confusion the path of these nerves through the ovipositor muscles is not shown. The names given to the nerves in the following description are my own. All the nerves mentioned herein are paired.

The anterior gonapophysal nerve.—This nerve (Figs. 3 and 4; I) arises near the caudal end of the seventh abdominal ganglion; it runs ventro-caudad to the ring muscle of the vagina. It enters this muscle and continues caudad paralleling the vagina. Near the anterior longitudinal sternal muscle of the eighth segment (Figs. 4 and 9; LSA), the nerve forks. The larger branch retains the name of anterior gonapophysal while the smaller branch is called the dorso-lateral branch.

Dorso-lateral branch of the anterior gonapophysal (Fig. 3; IA), as its name implies, runs caudad in a position dorso-lateral to the continuation of the anterior gonapophysal nerve. This branch ends in the vaginal ring muscle (Fig. 3; NRMV) just before the anterior longitudinal sternal muscle of the eighth segment is reached. The anterior gonapophysal nerve enters the anterior longitudinal sternal muscle (Figs. 4 and 9; LSA) just a few sections after its dorso-lateral branch has ended. Small branches are sent out from the nerve (Fig. 3; NLSA) into the anterior portion of the muscle.

Just a few sections caudad, the nerve enters the posterior longitudinal sternal muscle (Figs. 4 and 9; LSP); it sends out a dorsal branch (Fig. 3; NLSP) which runs to the muscle. After the dorsal branch has been given off, the anterior gonapophysal nerve runs along ventrad to the posterior longitudinal sternal muscle. The nerve continues down the anterior gonapophysis after the longitudinal sternals of the eighth segment have disappeared.

The caudal nerve.—This nerve (Figs. 3, 4 and 8; II) is the largest nerve in the three terminal abdominal segments of *Anax junius*. It arises from the caudal end of the seventh ganglion. Almost from its beginning the caudal nerve is observed to be two nerves joined together. These two constituent parts of the caudal nerve (the lateral and medial branches) run side by side throughout most of the eighth segment. Near the anterior edge of the anterior longitudinal sternal muscle, the lateral branch separates from the medial branch and runs underneath it and may now be known as the sterno-caudal nerve (Figs. 3, 4 and 8; III). The medial branch (Figs. 3, 4 and 8; II), the larger, retains the name of caudal nerve. It continues caudad through the ninth segment just under the gut and becomes the principal nerve of the tenth segment and does not innervate any muscles of the gonapophyses. The sterno-caudal nerve sends out branches in the ninth segment.

The Lateral Nerve (Fig. 3; IIIA) arises from the sterno-caudal nerve just before the posterior edge of the eighth segment. It runs ventro-laterad from the parent nerve. Shortly after entering the ninth segment the lateral nerve divides into the Tergo-pleural nerve and the continuation of the Lateral nerve; which latter nerve also divides into a superior and an inferior branch a few sections anterior to the tergo-sternal genital muscle (Figs. 4 and 8; TSG). Both branches are of the same size.

The Superior branch of the lateral nerve (Fig. 3; IIIA2) runs caudad touching the superior surface of the tergo-sternal genital muscle midway between its origin and the insertion. I could discover no branches of this nerve entering the muscle. The nerve continues caudad after the muscle ends.

The Inferior branch of the lateral nerve (Fig. 3; IIIA3) runs latero-caudad from the fork through the tergo-sternal genital muscle, appearing just beneath the inferior surface of that muscle midway between origin and insertion. This nerve sends branches into the posterior third of the tergo-sternal genital muscle. The inferior branch of the lateral nerve continues its path caudad after leaving the region of the above-mentioned muscle.

Tergo-pleural Nerve (Fig. 3; IIIA1) disappears into the tergo-pleural muscle (Fig. 3; NTP) in the anterior fourth of the ninth segment.

The Sterno-caudal Nerve (Figs. 3, 4 and 8; III), as we have already said, arises from the caudal nerve in the posterior part of the eighth segment. It runs along near the sternum. Near the posterior edge of the insertions of the tergo-sternal genital muscle, the sterno-caudal nerve forks into the lateral gonapophysal and the posterior gonapophysal nerves.

The Lateral Gonapophysal Nerve (Figs: 3, 5, 6, and 7; IIIB) runs close to the inter-gonapophysal muscle (Figs. 4 and 7; ING) which it probably supplies, although I was unable to see any branches going in that direction. After leaving the vicinity of this muscle, this nerve passes through the inferior portion of the longitudinal sternal muscle of the ninth segment (Figs. 4, 5 and 6; LS). Branches of this nerve were seen running into the longitudinal sternal muscle. It is assumed that the nerve also supplies the transverse sternal muscle (Figs. 4, 5 and 6; TRS) although no nerves were seen entering that muscle. After leaving this region, the nerve continues down the lateral gonapophysis.

The Posterior Gonapophysal Nerve (Figs. 3 and 7; IIIC) runs caudad into the posterior gonapophysis.

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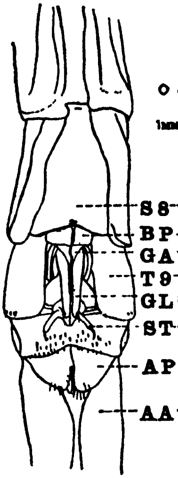
ABBREVIATIONS FOR FIGURES

AA	anal appendages
AP	anal plate
BP	basal plate
G	seventh ganglion
GA	anterior gonapophysis
GL	lateral gonapophysis
GP	posterior gonapophysis
IL	ileum
ING	inter-gonapophysal muscle
INLT	inferior longitudinal tergal muscle
LS	longitudinal sternal muscle of the ninth segment
LSA	anterior longitudinal sternal muscle of the eighth segment
LSP	posterior longitudinal sternal muscle of the eighth segment
M	median ridge on the sternite between the lateral gonapophyses
O	vagina
PD	posterior dorso-ventral muscle
RMV	ring muscle of the vagina
SC	one of a pair of sacs in the ninth segment of unknown function
S8	sternite of the eighth segment
SLT	superior longitudinal tergal muscle
ST	stylus of lateral gonapophysis
T9	tergite of the ninth segment
TP	tergo-pleural muscle
TRS	transverse sternal muscle
TSG	tergo-sternal genital muscle
I	anterior gonapophysal nerve
IA	dorso-lateral branch of the anterior gonapophysal nerve
II	caudal nerve
III	sterno-caudal nerve
IIIA	lateral nerve
IIIA1	tergo-pleural nerve
IIIA2	superior branch of the lateral nerve
IIIA3	inferior branch of the lateral nerve
IIIB	lateral gonapophysal nerve
IIIC	posterior gonapophysal nerve

The letter "N" prefixed to the abbreviation used for a given muscle in the diagram (Fig. 4) signifies that branches of the nerve in question supply that muscle.



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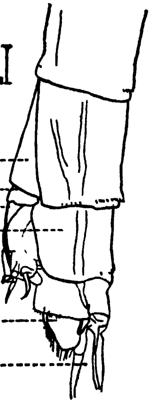

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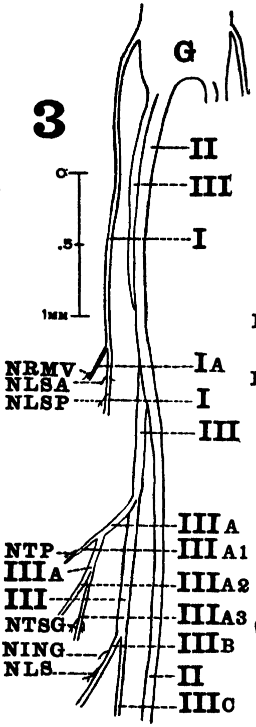

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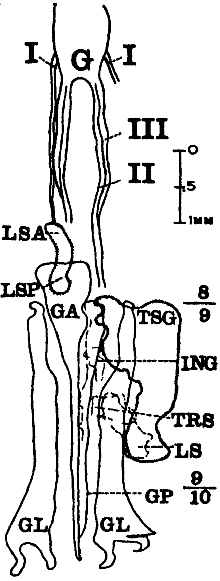


4

Fig. 1.—Ventral aspect of the terminal abdominal segments of *Anax junius*, showing external parts of the ovipositor. Drawn from a preserved specimen.

Fig. 2.—Lateral aspect of the terminal abdominal segments of the same specimen that was used in fig. 1.

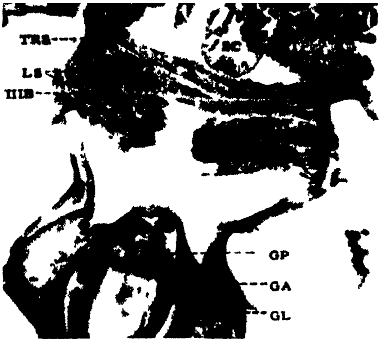
Fig. 3.—Diagram showing the nerves that supply the ovipositor.

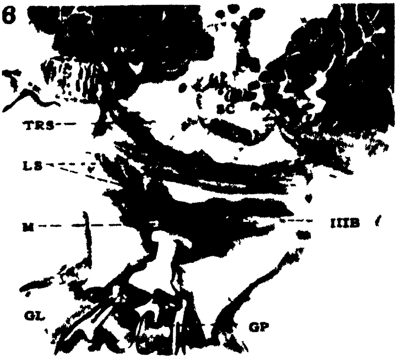
Fig. 4.—This figure is a graphic reconstruction based on the Lambert series of cross-sections. The second series of sections was used as a check on the Lambert series.

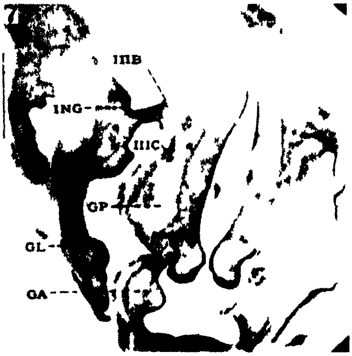
The figure represents the dorsal aspect of the structures concerned. The left anterior gonapophysis (GA) and the right posterior gonapophysis (GP) are shown here. The mates of these gonapophyses are omitted to avoid confusion. The lateral gonapophyses (GL) were moved a given distance from the center line to the right and the left for the same reason.

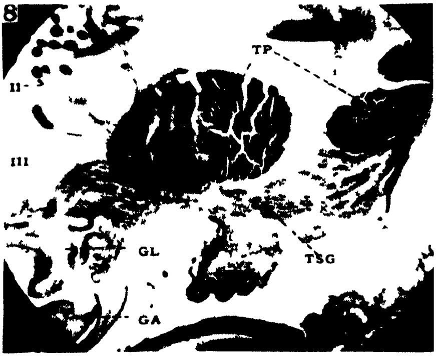
At the right of the figure the segments are indicated by Arabic numerals.

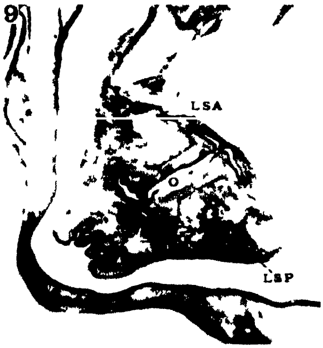
One member of each pair of gonapophysal muscles is shown in addition to half of the unpaired muscle. The origin of the Inter-gonapophysal muscle is in the lateral gonapophysis. Due to the moving of the lateral gonapophysis laterad out of its proper position, the origin of this muscle is not depicted in its proper position.











DUNCAN—ANAX JUNIUS

EXPLANATION OF PLATE VIII

The photographs for these figures were made by Mr. H. A. Walters, from the Lambert sections using a Spencer 10 × ocular and a Spencer 16 mm. objective. Figure 10 was made by using a Spencer 10 × ocular and the proximal part of a Leitz No. 3 objective.

Fig. 5.—Photograph of part of the 119th transverse section. Magnification 52 diameters.

Fig. 6.—Photograph of part of the 122nd transverse section. Magnification 46 diameters.

Fig. 7.—Photograph of part of the 156th transverse section. Magnification 22 diameters.

Fig. 8.—Photograph of part of the 187th transverse section. Magnification 41 diameters.

Fig. 9.—Photograph of part of the 211th transverse section. Magnification 38 diameters.

Fig. 10.—Photograph of the 403rd transverse section. Magnification 17 diameters.

ON THE DERMAPTERA AND ORTHOPTERA OF CHILE

PART ONE

BY JAMES A. G. REHN

(Plate IX, and Text Figure)

Since the publication of Blanchard's[1] and Philippi's[2] classic contributions, now seventy or more years past, no comprehensive study of the Chilean species of Dermaptera and Orthoptera has appeared. Numerous descriptions of new species, summaries of certain groups which occur in part in Chile, and many occurrence records are, however, to be found in a widely scattered literature.

The Academy of Natural Sciences of Philadelphia has possessed for nearly three decades a considerable series of Chilean Orthoptera material, portions of which I have drawn upon in studies of various groups, but by far the greater portion of which has remained unreported. During the past few years Mr. D. S. Bullock, of Angol, Chile, placed in my hands several most interesting Orthoptera series from the Angol region, and these supplied the needed fresh incentive for a long contemplated resumé of our knowledge of the Dermaptera and Orthoptera of Chile.

A careful analysis of the published literature, in the light of the series in hand, demonstrated, however, that the available material, while of great importance and containing much new information, was not comprehensive enough to warrant the preparation or publication at this time of a study of the character originally intended. The chief reason for this is the lack of available information on many of the older, inadequately described species, the placing of which, even with the aid of probably the best series of Orthoptera from the remainder of the Neotropical Region, is a most difficult matter. This is in part at least due to the fundamental insularity of the Chilean fauna as a whole.

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[1] Blanchard, Emilio. In Claudio Gay's, Historia Fisica y Politica de Chile, Zoologia, tome 6, Dermaptera and Orthoptera covering pp. 5–85, Atlas Orthoptera plate I, 1851–1854. (Orthoptera plates II and III are referred to in the text, but apparently these were not issued (see Scudder, Proc. Amer. Acad. Arts & Sci., xxxiii, p. 472, (1898).

[2] Philippi, R. A. Verzeichniss der im Museum von Santiago befindlichen Chilenischen Orthopteren. *Zeitschrift für die Gesammten Naturwissenschaften*, xxi, pp. 217–245, 1863.

In consequence at this time it seems most advisable to present a set of studies under the general title here used, and made up of sections grouped under special subtitles. In this way, it is my hope, resident entomologists may be interested and encouraged to help elaborate the scattered and exceedingly defective information now available, and if so it may be possible in a decade to present a comprehensive and critical work for Chile, which will rank with other important contributions to our knowledge of the zoology of that country which have recently appeared.

The present part is made up of two sections, the first, a resumé of our knowledge of Chilean Dermaptera, in which certain new synonymy is established as well as new records and comments presented; the second section comprises the more interesting results of an examination of the available Chilean Blattidae, in which two new genera and three new species are described, previously unknown features of older species are characterized and new synonymy and records given. Much additional information on species of Blattidae not discussed in this section is being held until unrepresented sexes are available for study.

My thanks are due Dr. J. Chester Bradley, through whose courtesy I have been permitted to study certain Chilean Dermaptera and Orthoptera belonging to Cornell University, and to my son, John W. H. Rehn, who spent many laborious hours tracing out scattered records and compiling a working catalog of the Chilean species.

ON THE DERMAPTERA OF CHILE

The following critical summary places on records previously unreported material, establishes new synonymy and summarizes the known distributional information bearing on the species of the country.

LABIDURIDAE

ESPHALMENINAE

This subfamily consists of but two genera, both of which occur in Chile, all the species of the subfamily being peculiar to southern and Andean South America except *Esphalmenus peringueyi* (Bormans) of South Africa.

Esphalmenus lativentris (Philippi)

1863. *Forficula lativentris* Philippi, Zeitsch. Gesamm. Naturwiss., XXI, p. 217. [♂, ♀; Province of Valdivia, Chile.]

Valdivia; (A. Montealegre); one male; [Cornell University].

In his original description Philippi confused the sexes, as he described the male as the female and vice versa. The present specimen is larger than any other of the species which I have seen, measuring 13 mm. in total length of body (exclusive of forceps), 3.52 in length of forceps, and 4.36 in greatest width of anal segment. Compared with these dimensions a Concepcion male, now before me, measures 9.6, 2.26 and 2.91 respectively. As Philippi's original measurement, including forceps, was 5½ to 6 lines, it is evident the Concepcion specimen is of approximately the same size as the original material.

Philippi's *lativentris* is a species of central Chile, having been recorded from localities extending from Aconcagua Province south to Valdivia. The specific records, in addition to the original one and that here presented, are San Rosendo, San Vicente, Temuco and Pitrufquen (Borelli); Concepcion and Penco (Rehn); Province of Aconcagua (Hebard) and Santiago (Burr). Bormans' 1883 record of *lativentris* from Obrajillo, Peru[3] is now known to be *E. inca* (Burr),[4] while the record of it from the Straits of Magellan, published by Bormans at the same time,[5] is thought by Burr[6] to refer to the Patagonian *E. silvestrii* Borelli.[7]

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[3] Ann. Soc. Ent. Belg., XXVII, p. 62, pl. 2, fig. 3, (1883).

[4] *Gonolabis inca* Burr, Ann. and Mag. Nat. Hist., (7) XI, p. 272, (1903). [♂, ♀; Obrajillo, Cordilleras of Peru.]

[5] Ann. Soc. Ent. Belg., XXVII, p. 62, (1883).

[6] Revista Chilena Hist. Nat., XVII, p. 169, (1913).

[7] Vide infra.

The material of *lativentris* from Buenos Aires, recorded by Bormans in his 1883 paper, is probably erroneously labelled, or, being females, may represent another species of which the male is unknown, as suggested by Burr.[8]

The sternal aspect of *lativentris* has been well figured by Burr.[9]

The only information we possess on the seasonal occurrence of the species is that the Penco and Concepcion specimens were taken in December.

Esphalmenus silvestrii (Borelli)

1902. *Gonolabis silvestrii* Borelli, Bollett. Mus. Zool. Anat. Comp. Torino, XVII, no. 418, p. 4, figs. a and b. [♂, ♀; Vicinity of Rio Santa Cruz, Patagonia.]

Burr in 1913[10] suggested the material from the shores of the Straits of Magellan recorded by Bormans as *lativentris*,[11] belongs instead to the present species. As true *lativentris* appears to be limited to a region nearly a thousand miles distant, and the type locality of *silvestrii* is less than two hundred miles from the eastern portion of the Straits of Magellan, I feel Burr's suggestion is well founded and probably correct. The eastern portion of the Straits is also similar in character to southern Patagonia.

Esphalmenus porteri Burr

1913. *Esphalmenus porteri* Burr, Revista Chilena Hist. Nat., XVII, no. 3, pp. 167, 168, 170, fig. 21. [♂, ♀; Aconcagua, Chile.]

This species is a uniformly dull black one, of quite small size (body ♂, 10 mm.; ♀, 8), probably limited in distribution to areas of considerable elevation. I have seen no material of *porteri*, which was taken in January.

Gonolabina spectabilis (Philippi)

1863. *Forficula spectabilis* Philippi, Zeitsch. Gesamm. Naturwiss., XXI, p. 218. [♂, ♀; Andes of Santiago Province, Chile.]

1902. *Gonolabina kuhlgatzi* Verhoeff, Sitzungsb. Gesell. Naturf. Freunde Berlin, 1902, p. 8. [♂, ♀; Tumbes, Chile.]

Valparaiso Province; (A. Faz); one male, one female; [Cornell University].

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[8] Revista Chilena Hist. Nat., XVII, p. 169, (1913).

[9] Genera Insect., Dermapt., pl. 2, fig. 13, (1911).

[10] Revista Chilena Hist. Nat., XVII, no. 3, p. 169.

[11] Ann. Soc. Ent. Belg., XXVII, p. 62, (1883).

A careful study of Philippi's description shows there can be no doubt his species is that to which Verhoeff later gave the name *Gonolabina kuhlgatzi*, and used as the basis of the latter genus. Philippi's description is detailed and explicit, and emphasizes numerous features, such as the presence of two marginal dentations caudad on the anal segment. Burr,[12] evidently following Bormans and Krauss[13] who never saw the species, referred *spectabilis* to the genus *Anisolabis*, while Verhoeff, of course, did not consider Philippi's name.

This monotypic genus is a most unusual type, which has the anal segment and the pygidium fused in both sexes. Burr's excellent figures in the Genera Insectorum[14] show very clearly the form of the anal segment, and of the male forceps and the sternal lobes of the species.

The specimens in hand agree quite well with the measurements already published by Philippi and Verhoeff. The sole information on seasonal occurrence is that the species was taken in June (Verhoeff). Apparently it is rare and probably limited to central Chile, while its vertical range is unknown.

PSALINAE

Euborellia annulipes (H. Lucas)

1847. *Forficelisa annulipes* H. Lucas, Bull. Soc. Ent. France, (2) v, p. lxxxiv. [Sex?; Jardin des Plantes, Paris (probably introduced).]

1851. *Forficula annulicornis* Blanchard, in Gay, Hist. Fisica y Politica de Chile, Zool., vi, p. 10. [♀; Chile.]

Masa Tierra Island, Juan Fernandez Group; December 4, 1913; (R. H. Beck); two females; [Hebard Cln.].

The Masa Tierra specimens are inseparable from an extensive series of this nearly cosmopolitan species. The synonymy of Blanchard's *annulicornis* was established by Burr,[15] on the basis of Dohrn's 1864 comments[16] on a specimen in the Paris Museum labelled as *annulicornis* by Blanchard. Although the latter's description specifically mentions the presence of small, scale-like tegmina, Dohrn points out that the specimen examined by him was apterous, and that Blanchard was probably misled by lateral impressions on the mesonotum giving the impression of narrow, scale-like tegmina. As no other psalid with narrow lateral tegmina has, to my knowledge, been seen from Chile by recent workers, this explanation is probably correct, although it is possible, but less probable, that relatives of *E. janeirensis* (Dohrn) of eastern Brazil, or *scudderi* (Bormans) of Amazonia, both possessing lateral, scale-like tegmina, may reach Chile.

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[12] Genera Insectorum, Dermpatera, p. 30, (1911). (As *Gonolabina kuhlgatzi.*)

[13] Das Tierreich, lief 11, p. 47, (1900).

[14] Genera Insectorum, Dermaptera, pl. 2, figs. 11, 11a, (1911).

[15] Genera Insectorum, Dermaptera, p. 29, (1911).

[16] Stett. Ent. Zeit., xxv, p. 290.

The species has been recorded as *annulipes* from Pascua or Rapa-Nui Island, ten miles from the coast off Caldera, Atacama Province, by Fuentes[17] on the basis of a determination by Burr, and probably this is the species which has been reported as *annulicornis* from Santiago Province by Philippi;[18] from the Valley of Marga-marga, Valparaiso Province[19] and from Atacama Province[20] by Porter, and Valparaiso Province without further data by Porter and Edwards.[21]

Euborellia antoni (Dohrn)

1864. *F[orcinella] antoni* Dohrn, Stett. Entom. Zeit., xxv, p. 289. [♂; Venezuela.]

Burr in 1908[22] reported this species from Chile, giving the source of the material in the Paris Museum as "Gay, 1843." The sex is not mentioned, neither is any comment given as to the possibility of Blanchard having referred this material to some other species. Naturally such a query arises in connection with any of Gay's collections.

Dohrn's *antoni* ranges from Panama to Montevideo, Uruguay, and Burr's record carries it to the Pacific Coast of southern South America.

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[17] Bol. Mus. Nac. Chile, VII, p. 313, (1914).

[18] Zeitsch. Gesamm. Naturwiss., XXI, p. 218, (1863).

[19] Revista Chil. Hist. Nat., I, p. 22, (1897).

[20] Revista Chil. Hist. Nat., III, p. 181, (1899).

[21] Revista Chil. Hist. Nat., I, p. 13, (1897).

[22] Bull. Mus. Hist. Nat., Paris, 1908, p. 31, (1908).

LABIDURINAE

Labidura riparia (Pallas)

1773. *Forficula riparia* Pallas, Reise Russischen Reichs, II, buch 2, Anhang, p. 727. [♂; Shores of the Irtysch (Irtın) River, western Siberia.]

Limache, Valparaiso Province; (A. Faz); one male; [Cornell University]. Valparaiso Province; (A. Faz); three males, three females; [Cornell University].

The above-listed specimens of this broadly distributed species have been carefully compared with a topotypic male from the shores of the Irtysch River, near Omsk, Siberia, and material from Valencia, Spain and other south European localities. The Valparaiso Province male individuals cannot be separated from a male from Valencia, Spain, and from that from the Irtysch River only in their average darker coloration. In every structural detail and in the pronotal, tegminal and abdominal sculpture there is no difference in any way from the Siberian and south European males. The Chilean females, aside from their average darker coloration, are similarly identical. It is quite probable that the original source of Chilean *riparia* was Spain.

No exact previous record of *riparia* from Chile exists in the literature, although Burr in 1907[23] reported a female from Chile, without exact locality, as *L. erythrocephala*. The material cited above, however, supplies definite information on the species' occurrence there.

BRACHYLABIINAE

Brachylabis chilensis (Blanchard)

1851. *Forficula chilensis* Blanchard, in Gay, Hist. Fis. y Polit. de Chile, Zool., VI, p. 10, Atlas, pl. 1 Ortópteros, fig. 1. [♂; Chile.]

1851. *Forficula testaceicornis* Blanchard, in Gay, Hist. Fis. y Polit. de Chile, Zool., VI, p. 11. [♀; Chile]

This species is unknown to me from material, and the above synonymy dates from Dohrn,[24] who examined Blanchard's original material in Paris, and found the two names to be based on sexes of the same species.

No information is available as to the species distribution or seasonal occurrence in Chile, where it was not encountered by Philippi. It has been reported from Entre Rios, Argentina;

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[23] Bull. Mus. Hist. Nat., Paris, 1907, p. 512, (1907).

[24] Stett. Ent. Zeit., XXV, p. 295, (1864).

Theresopolis, Brazil and Baeza, Ecuador, but of these at least the Brazilian record is in all probability correctly referable to a more recently described species.

In addition to the species definitely recorded from Chile, Navas in his compiled summary of the Dermaptera of that country,[25] included three widely distributed South American and one nearly cosmopolitan species as probable occurrences. These are *Labidura xanthopus* (as *L. bicolor* Kirby), *Spongiphora croceipennis, Forficula auricularia* and *Doru lineare* (as *Apterygida taeniata*). It is possible *Forficula auricularia* may occur as an introduction, but there is no published information to this effect. Of the other species *S. croceipennis* most certainly does not occur, as it is not a species of either temperate or desert regions, while *Doru lineare* requires warmer conditions than are to be found in Chile outside of its desert section, and *Doru* is not a truly desert genus. The species *Labidura xanthopus* is one of southern Brazil, Paraguay and northern Argentina, and very probably does not cross the Andes at any point. The latter cordillera to the east and the Atacama Desert to the north have probably acted as impassable barriers to the passage of many of the genera of Dermaptera occurring under subtropical conditions in eastern or more northern South America.

NEW GENERA AND SPECIES OF BLATTIDAE, WITH RECORDS AND SYNONYMY OF OTHERS

PSEUDOMOPINAE

PHIDON[26] new genus

This very distinct genus suggests in many of its features *Eudromiella* Hebard,[27] which latter contains upwards of seven species ranging from Central America to northern Argentina.

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[25] Rev. Chilena Hist. Nat., IX, pp. 294–299, (1905).

[26] From Φείδων, one of the thirty tyrants at Athens.

[27] Mem. Amer. Ent. Soc., no. 4, pp. 27, 34, (1920). Genotype.—*E. bicolorata* Hebard.

In a number of features, however, *Phidon* stands quite apart, and its definite affinities are not at all clear. It agrees with *Eudromiella* in the basic features of tarsal structure and limb spination, in the general type of male dorsal abdominal specialization and the direction of the tegminal discoidal sectors. It differs, however, in the pronotum of the male being deplanate and not transversely vaulted, in the head of the same sex being distinctly depressed, in the more membranous male tegmina and the irregularly branched and disposed and less direct discoidal sectors of the same.

The general appearance of *Phidon* suggests an ancient type, while the tegminal venation of the male faintly recalls the genus *Ectobius*, but the equal tarsal claws of *Phidon* and the alar structure and venation at once show this is purely superficial. Agreement in numerous features with *Eudromiella* would seem to indicate real, even if relatively remote, common ancestry. There is, however, an ensemble to the males of the species of *Phidon* here discussed, which is thoroughly distinctive and at once sets them apart from other South American genera of the subfamily. The acquisition of unquestioned females of the genus is awaited with interest.

Generic Description.—Fully alate in male: form in that sex elongate ovate, moderately depressed. Head cordiform in outline, subdeplanate in male; interocular space nearly equal to space between antennal scrobes. Pronotum of male trapezoidal to transverse ovate, always broader than long, disk undulato-subdeplanate. Tegmina of male ample, surpassing abdominal apex, lanceolate, membranous, apex rounded acute; anal field elongate, narrow pyriform; costal veins in large part regular; discoidal sectors oblique, sometimes (*reticularis*) markedly phylliform in ramification and direction; venation with (*araucanus*) or without numerous raised points. Wings of male fully developed, intercalated triangle evident but narrow; costal veins elongate clavate, discoidal vein in large part straight, ulnar vein with three to four complete and none to two incomplete rami. Dorsum of abdomen of male with seventh tergite bearing a median circular glandular specialization; ultimate tergite (supra-anal plate) of male strongly transverse, low trigonal; ultimate sternite (subgenital plate) of male trigonal in ventral outline, with a small medio-distal acute production separating vertically disposed flap-like styles. Cephalic femora[28] with ventro-cephalic margin bearing two distal spines and a proximal group of two or more large spines, separated by a numerous piliform series; ventro-caudal margin of cephalic femora with one to two spines mesad and a single one distad: median and caudal femora with ventral margins well spined. Caudal tarsi with metatarsus slightly longer than remaining joints combined, ventral surface biseriately spinulose; small but distinct pulvilli present distad on all four proximal articles; tarsal claws equal in length, margins simple; arolia well developed.

Female?[29]

GENOTYPE: *Phidon bullocki* new species.

Key to Species

(Based on males.)

1. Tegmina surpassing apex of abdomen by less than pronotal length; discoidal sectors of same more regularly oblique in disposition. (Size small for genus; pronotal disk bistrigate laterad.) .... *bullocki* new species

Tegmina surpassing apex of abdomen by more than pronotal length; discoidal sectors of same less regularly oblique in disposition and in character more ramifying 2

2. Pronotum symmetrically trapezoidal in outline; disk of same with pattern of dark punctulae, not broadly maculate laterad. Tegmina with discoidal sectors less definitely phylliform in character or branching; all tegminal veins or rami with numerous raised and infuscate points. *araucanus* new species

Pronotum transverse elliptical in outline; disk of same with dark punctulae and laterad also broadly maculate. Tegmina with discoidal sectors distinctly phylliform in character and bifurcation; tegminal veins and rami without raised infuscate points .... *reticularis* (Blanchard)

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[28] Cephalic femora missing in unique type of *P. araucanus*.

[29] Saussure described the female sex of *P. reticularis* (Blanchard) as having much the same size and general development as the male, fully alate and similarly patterned. I have adult females of two quite distinct species from Chile which may belong to the present genus, but I wish to await further information or definite confirmation of this possibility before discussing them more fully. Both are brachypterous, with abbreviate, quadrate tegmina, and they exhibit certain differences in spination from the known males of *Phidon*. In no case were they taken with the latter, and until our knowledge is greater attempts to associate them with *Phidon* males are premature.

Phidon bullocki[30] new species (Pl. IX, figs. 1–4.)

The small size of this species, the strongly bistrigate pronotal disk of the male, the more regularly oblique discoidal sectors of the tegmina of the same sex, and the details of the male ultimate sternite (subgenital plate) will at once distinguish it from the other species of the genus known to me.

Type.—♂; Angol, Malleco Province, Chile. Elevation, 1200 meters. March 10, 1929. (D. S. Bullock.) [Academy of Natural Sciences of Philadelphia, Type no. 5523.]

Size small (for genus): surface moderately polished.

Head with greatest width across eyes subequal to depth of head: occipital interspace between eyes broad, subequal to interscrobal interspace; frons in profile broadly rounding from occiput to lower face: eyes in profile subreniform, narrowing ventrad: palpi with ultimate article somewhat longer than penultimate (as 15 to 12), latter distinctly infundibuliform. Antennae damaged.

Pronotum trapezoidal, greatest width briefly caudad of middle of length, greatest length contained slightly less than one and one-half times in greatest width (as 28 to 41); cephalic margin arcuato-truncate, broadly rounding to the caudad divergent, weakly arcuate lateral margins, which broadly round over point of greatest width to the broad, obtuse-arcuate caudal margin: surface of disk undulate, relatively narrow lateral portions moderately declivent.

Tegmina subequal lanceolate, greatest width in middle third, contained three and one-fifth times in greatest length of same: apex well but rather narrowly rounded, sutural side more oblique arcuato-convergent than costal: scapular field but two-fifths of tegminal width (as 15 to 38); anal field elongate pyriform, narrow, but one-third as wide as length of field: humeral trunk in general straight distad of slight proximal sinuosity; costal veins ten to eleven in number, the proximal two to four ramose, all markedly oblique; discoidal sectors five in number in left tegmen, distal two bifurcate, all discoidal sectors regularly oblique and evenly disposed; normally covered portion of right tegmen with discoidal sectors less direct and more sinuose; intercalated nervures regularly marked, cross nervures producing areolae usually quadrate or rectangulate in shape; four marked axillary veins present. Wings with intercalated triangle narrow, apex of anterior field rounded: costal veins (of various origins) nine in number, several distal ones bifurcate, all oblique, second to sixth somewhat incrassate: discoidal vein straight; medio-discoidal area slightly wider than medio-ulnar; ulnar vein with four complete and one incomplete (very brief) rami.

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[30] Dedicated to Mr. D. S. Bullock, of Angol, Chile, to whose energy much of this collection, and considerable of our knowledge of the animal and plant life of Chile, is due.

Dorsal surface of abdomen with lateral stigmata quite marked and foraminose on tergites two to seven; seventh tergite with median glandular specialization consisting of a circular, shallow, saucer-like depression, equal to two-thirds the length of the tergite, and bearing a raised central boss, which with the surface of the depression is densely covered with adpressed hairs disposed and radiating from paired lateral centers; meso-caudal sections of distal margin of sixth tergite shallowly and concavely infolded about base of median specialization; distal margin of seventh tergite shallowly bisinuate, mesad shallowly subangulate concave: ultimate tergite (supra-anal plate) brief, strongly transverse, distal margin broadly obtuse-angulate, immediate angle faintly subrostrate and obtuse-angulate: single cercus preserved has been injured and is abnormal, consisting of but six articles: ultimate sternite (subgenital plate) as seen from venter trigonal, lateral portions bent dorsad the sinistral the more sharply so and in addition bent inward, the two reflexed sections of sternite unsymmetrical, the dextral broader than the more rim-like sinistral side, borders of latter nearly straight in profile, of dextral side expanded dorsad in a circular lobule about stylar base, which area as well as the adjacent portion of the margin itself has numerous short stout chaetae; distal portion of tergite, as seen from venter, narrow, the margin concave about stylar bases, but with the narrow, compressed, vertically sublamellate process between the styles slightly shorter than latter, and with its narrow distal surface covered with minute imbricate shagreenous teeth: dextral style vertical, lamellate, broad subcircular in lateral outline, concave on dextral face, its periphery with a few long spaced chaetae; sinistral style similar in character but smaller and longer than deep, rounded distad, concave on sinistral face, similarly with a few scattered chaetae.

Cephalic femora with proximal large spines on ventro-cephalic margin four to six in number; ventro-caudal margin of same with two median and one distal large spines. Caudal tarsi with metatarsus to remaining articles as 55 to 53.

Coloration.—General color light ochraceous-buff, the dark pattern mars brown to prout's brown. Head pale, with occiput and interantennal portion of face solidly prout's brown except for ocellar spots, pale outlining of eye margin and a pale vertical median dividing line ventrad; distal palpal article clouded with brown; eyes mummy brown. Pronotum with lateral areas vitreous hyaline; disk of pale base color, laterad with broad, solid, sigmoid bars of prout's brown, not reaching the cephalic and but weakly touching the caudal margin, external margins of bars well defined, internal margins of same less decided, the bars distinctly converging but not joining cephalad: pale disk with a pair of separate, longitudinal dark dashes mesad, close to the heavy bars, and caudad of these maculae, near caudal margin, two pair of less definite dark punctae, the more caudal pair more widely separated than the other. Tegmina with humeral trunk proximad distinctly lined with prout's brown, this continuing distad as a finer pencilling, the costal veins, most of the discoidal sectors and the proximal section of the axillary veins similarly but more lightly pencilled with cinnamon-brown to buckthorn brown. Wings with venation weakly outlined with buckthorn brown, the thickened costals darkened to dresden brown. Dorsum of abdomen intermarginally clouded with brownish, more evident distad, there becoming dresden brown and on the sixth tergite covering nearly all of same except narrow pale lateral margins, seventh tergite largely infuscate, more distal tergites largely pale: venter of abdomen with lateral series of intermarginal subtrigonal markings of prout's brown, distal extremity largely buckthorn brown; cerci nearly as dark as mummy brown. Tibiae narrowly pencilled with prout's brown at insertions of spines; all tarsi clouded distad to some extent with dresden brown.

Measurements.—Length of body, 10 mm.; length of pronotum, 2.35; greatest width of pronotum, 3.44; length of tegmen, 10.2; greatest width of tegmen, 3.19.

The type of this beautiful species is unique.

Phidon reticularis (Blanchard) (Pl. IX, figs. 5–7.)

1851. *Blatta reticularis* Blanchard, in Gay, Hist. Fisica y Politica de Chile, Zool., vi, p. 152. [♂; South of Chile]

1863. *Bl[atta] reticularis* Philippi, Zeitschr. Gesammt. Naturwiss., xxi, p. 221. [Valdivia Province, Chile]

1870. *Blatta reticularis* Saussure, Miss. Scient. du Mexiq., Rech. Zool., vi, p. 29. (Redescription of type.)

Concepcion; January 27 and February 10, 1904; (Carlos S. Reed); two males; [A.N.S.P.].

The original description of *reticularis* is not sufficiently definite to permit unquestionable decision whether the present species or the new *araucanus* was before Blanchard. The 1870 redescription of the type by Saussure (vide supra), however, supplies enough information on deficiencies of the original to show that *reticularis* is the present species. Saussure also measures the tegmina and briefly describes the ultimate sternite (subgenital plate) of what he considers the female of *reticularis*. The tegmina are said to be 13.5 mm. long, against 14 in the male (Saussure's measurement), and the ultimate sternite is given as "en triangle très-allongé."

My colleague Mr. Morgan Hebard, in 1927, also examined Blanchard's type in the Paris Museum. It is a male, collected by Gay in 1836, and Mr. Hebard's notes have been of further value to me. No mention is made in them of any accompanying females, and for various reasons I feel Saussure may not have made physical comparison of the sexes as understood by him.

The more salient distinctive features of the male sex of *reticularis*, compared with the preceding description of *P. bullocki*, are as follows.[31]

Size larger. Head slightly broader than deep, width across eyes to depth as 47 to 44; frons in profile showing a very faint angulation between ocellar spots. Antennae somewhat surpassing body in length (apices incomplete), distad of second article appreciably clothed with short hairs and longer, sparser chaetae.

Pronotum transverse angularly subelliptical, greatest width but very faintly caudad of middle, equal to one and one-half times greatest length of same (as 48 to 32); cephalic margin broad, nearly equal to width of head, truncato-arcuate, laterad by rounded but evident obtuse-angulations passing to the oblique, gently-arcuate, caudad diverging cephalic sections of the lateral margins, point of greatest width evenly but rather narrowly rounded, caudal sections of lateral margins shorter than cephalic sections, oblique subarcuate, strongly converging to the broad, weakly obtuse-angulate caudal margin, joining the latter by distinct but rounded angles: surface of disk deplanate, somewhat undulate, caudo-laterad with paired caudad-converging impressions; hyaline lateral areas broad, weakly declivent.

Tegmina lanceolate, surpassing apex of abdomen by distance equal to length of pronotum, relatively broad, greatest width slightly distad of middle, contained slightly less than three times in greatest length (as 55 to 162): anal field elongate subpyriform, greatest width about five-twelfths of length of same (as 25 to 62): humeral trunk distad of weak basal curvature in general straight, but resembling the venation of a leaf in the irregularity and indirection of the minutae of its course; costal veins ten to twelve in number, some bifurcate and one or more distad may be ramose; discoidal sectors of all origins eight to nine in number, three to four bifurcate or even ramose, oblique or arcuate oblique (on normally covered portion of dextral tegmen) in trend, and in the indirect character of their continuity resembling the humeral trunk. Wings with intercalated triangle narrow, small: costal veins (of various origins) nine in number, two or more distad bifurcate or ramose, second to sixth lightly incrassate; mediodiscoidal area subequal in width to medioulnar; ulnar vein with four to five complete and one incomplete rami.

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[31] Based chiefly on the Concepcion male above listed taken on January 27, 1904.

Dorsal surface of abdomen with lateral stigmata less strongly defined than in *P. bullocki;* specialization of seventh tergite similar to that of the last mentioned species: cerci elongate fusiform, depressed, tapering distad in distal five-eighths, composed of nine articles, ultimate blunt acute, each sharply individual marginally, particularly on external border: ultimate sternite (subgenital plate) in ventral aspect trigonal, but proportionately broader than in *P. bullocki*, less subrostrate distad, margins and median process essentially as in *bullocki;* styles similar to those of *bullocki* but shorter, less produced, both proportionately broader, distinctly deeper than long, broadly rounded marginally, with scattered elongate chaetae.

Cephalic femora with three to five proximal large spines on ventro-cephalic margin.[32] Caudal tarsi with metatarsus to remaining articles as 69 to 60.

Coloration.—Main features of color pattern as in *P. bullocki* with the following differences. Dark pattern cinnamon-brown to prout's brown. Head with dorsal section of clypeus dark; most of palpi clouded with brown. Antennae distad of two pale proximal articles uniformly dresden brown. Pronotum with lateral dark bars of disk paler, broader, more nebulous and areolate-eroded, particularly meso-cephalad, pale area separating dark bars sharply contrasted, with analogs of the dark paired dashes of *bullocki* fused into the lateral bars, and with a weak, reversed Y-shaped median dark marking. Tegmina with darker pencilling of humeral trunk more continuous, weakening uniformly distad, of other veins essentially as in *bullocki*. Abdominal coloration similar but weaker and less contrasted than in *bullocki*. Limbs similar.

Measurements.—The two males before me measure (in millimeters) as follows: length of body, 12.5, 10.9; length of pronotum, 2.68, 2.52; greatest width of pronotum, 4.03, 3.69; length of tegmen, 13.6, 13; greatest width of tegmen, 4.62, 4.11.

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[32] The other specimen has but a single such spine on each cephalic femur.

The few exact localities from which this species is known show that it is a native of that portion of Chile south of a Valparaiso-Santiago line, and that Blanchard correctly stated it was an inhabitant of the southern part of the country.

Phidon araucanus[33] new species (Pl. IX, figs. 8–10.)

This species and *reticularis* have been compared with *P. bullocki* under the latter species. From *reticularis* the present species differs in the male sex (the only one known) in its slightly smaller size, more trapezoidal pronotum, somewhat more regular disposition and division of the discoidal sectors of the tegmina, in the presence of raised and infuscate points on the tegminal venation, the absence of paired dark lateral cloud maculations from the pronotal disk and numerous other color features, as well as details of the male genitalia.

Type.—♂; Chile. [Hebard Collection, Type no. 1235.]

Size medium (for genus). Head slightly broader than deep (as 43 to 40): interspace at occiput slightly greater than that between antennal scrobes (as 14 to 12); occiput in profile evenly rounding over frons to face, as in *P. bullocki;* palpi with ultimate and penultimate articles subequal in length, the latter evenly infundibuliform. Antennae lacking distal portions.

Pronotum subtrapezoidal, more nearly resembling that of *P. bullocki* than of *P. reticularis,* greatest width at three-fifths of length, greatest length in width nearly one and one-half times (as 30 to 43); cephalic margin broad low arcuate, evenly rounding into the caudad diverging, nearly straight oblique cephalic portions of the lateral margins, which broadly round over point of greatest width to the brief caudal portions of the lateral margins, which in their arcuation are hardly separated from the broad, weakly convex caudal margin: surface of pronotum with the paired, caudad converging impressions bounding the disk caudolaterad marked; hyaline lateral areas broad, somewhat declivent latero-cephalad.

Tegmina much as in *P. reticularis,* greatest width contained three times in length: anal field narrow pyriform, greatest width contained two and one-half times in length of same: venation in general character similar to that of *P. reticularis;* costal veins thirteen in number, several of more distal ones bifurcate to ramose; discoidal sectors of all origins five in number, most of them bifurcate or ramose, weakly radiating in general disposition and with some indirectness of course; axillary veins five in number; all the costal, discoidal and most of the axillary venation showing small but definite, regularly placed moderately thickened nodulations, as many as ten on a single costal vein, as a whole more evident toward the margins of the tegmina. Wings with costal veins (of various origins) nine in number, three distad bifurcate, second to sixth appreciably thickened, seventh and eighth very faintly so; medio-discoidal area slightly broader than the medio-ulnar one; ulnar vein with three to four complete rami, which may or may not be bifurcate.

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[33] To perpetuate the name of the Araucanian Indians, who have played so conspicuous a part in the history of Chile.

Doral surface of abdomen as in other species of genus, stigmata as in *P. reticularis:* cerci damaged: ultimate sternite (subgenital plate) in character very similar to that of *P. bullocki* but dorso-dextral margin with its dorsal extension as a whole more evenly arcuate; styles essentially as in *bullocki.*

Cephalic limbs and caudal tarsi missing.

Coloration.—General base color light ochraceous-buff, dark markings cinnamon-brown to prout's brown. Head with occiput and inter-ocellar area buckthorn brown, the occiput with a medio-longitudinal pale line, face with a poorly marked transverse arcuate russet cloud between antennal scrobes; eyes deep prout's brown; antennae pale with two proximal articles lightly clouded with prout's brown; palpi with ultimate article tipped with prout's brown. Pronotum with hyaline lateral area relatively broad, narrowing markedly cephalad; disk with a very definite dark punctulate pattern consisting mesad of a pair of groups of a dozen or so points each and meso-caudad of a transversely disposed subtrigonal group of six or so punctulae. Tegmina with humeral trunk distinctly pencilled with prout's brown proximad, paling progressively distad to very weak buckthorn brown, which is the general tint of most the other longitudinal tegminal venation, some portions of the veins entirely untinted; venation nodules dresden to prout's brown. Wings with venation as a whole faintly washed with pale yellow ocher, including costal thickenings. Abdomen dorsad much as in *P. bullocki* but infuscation of sixth tergite less extensive cephalad; venter of abdomen with solid but nebulously defined intermarginal bars of prout's brown, which leave broad pale marginal areas and proximal an extensive median pale section, the dark intermarginal bars coalescing briefly before the apex, which is also pale bordered. Tibiae with their spine insertions narrowly pencilled with fuscous; extreme apex of tarsi moderately infuscate.

Measurements.—Length of body, 10 mm.; length of pronotum, 2.52; greatest width of pronotum, 3.61; length of tegmen, 12.6; greatest width of tegmen, 4.2.

The type of this species is unique.

MOLUCHIA[34] new genus

This generic aggregation is, as far as known, peculiar to the Chilean region, and the future doubtless will show it contains a number of species additional to these here discussed. This is indicated by certain female individuals, without accompanying males, which are now before me. I have not attempted to describe these species, preferring to await the acquisition of males, which will show the very distinctive features to be found in that sex.

The nearest relatives of *Moluchia* are *Symploce* Hebard[35] and *Nesomylacris* Rehn and Hebard.[36] The former embraces many Old World species, both African and Oriental, a number of West Indian representatives, and one species of unknown locale, possibly adventive on the coast of eastern and western Mexico, in Southern Florida and in the Hawaiian Islands. The genus *Nesomylacris* is West Indian, with three known species from Cuba and Jamaica. The apparent absence of both of these genera from the mainland of the Americas except for one species a probable adventive at two widely separated points, would indicate that these symplocoid genera, at least as existing to-day, did not originate in America. The broad diversification of *Symploce* and its close relationship to *Blattella*,[37] a typically Old World genus, point to a relatively long and, in large part, probably non-American history. The occurrence of a related dominant genus in Chile would seem to be additional evidence of the relative antiquity of the Chilean fauna, and its marked differentiation from that of the remainder of continental South America.

From both *Symploce* and *Nesomylacris* the new genus can be distinguished with assurance only in the male sex, as its chief differential feature is in the character of the specialization of the dorsum of the abdomen of the male. In *Moluchia* this specialization is always in the form of transverse elevated ridges, one on each side of the median line, and present on a variable number of tergites, always found on the proximal and sometimes present on all as far distad as the seventh. There is never a definite distal center of specialization (seventh tergite or thereabout), as usual in *Symploce*, nor are the caudo-lateral angles of the tergites at all produced. The cerci are heavy, incrassate and but bluntly fusiform in both sexes, the styles of the ultimate sternite (subgenital plate) of the male are similar and simple in development, although the sternite is asymmetrical. The tegmina and wings may be well developed (known only in the male sex) or greatly reduced. In the reduced tegmina the venation is always clearly indicated and the texture is never as coriaceous as in *Nesomylacris*, which also has distinctly different specialization of the distal palpal article.

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[34] From Molu-che, the native name of the Araucanian Indians.

[35] Trans. Amer. Ent. Soc., XLII, p. 357, (1916). Genotype.—*S. capitata* (Saussure).

[36] Bull. Amer. Mus. Nat. Hist., LIV, pp. 7, 137, (1927). Genotype.—*N. relica* R. & H.

[37] See Rehn, Proc. Acad. Nat. Sci. Phila., LXXXIV, pp. 426–427. (1933).

Generic Characters.—Fully alate to brachypterous; wings functional and with distinctive and complete venation, to functionless rudiments with merely vestigial venation.[38] Head pyriform in outline; occipital interspace between eyes broad in both sexes. Pronotum trigonal in general outline, in transverse section low arcuate; latero-cephalic portions of margins appreciably more decurved than elsewhere. Tegmina in fully alate condition elongate lanceolate, equalling apex of abdomen; costal margin regularly arcuate, apex narrowly rounded; discoidal vein bifurcate at distal fourth to fifth; discoidal sectors longitudinal; anal field elongate subpyriform: in brachypterous condition but little longer than pronotum, subquadrate with distal margin subtruncate, or oblong with caudo-lateral angle broadly rounded; venation very definite and complete, anal vein joining sutural margin at distal third or fourth. Wings in fully alate condition falling little short of tegminal apices; costal veins non-incrassate; discoidal vein bifurcate at distal third; ulnar vein bifurcate, no incomplete rami present:[39] wings in brachypterous individuals mere articulate flaps, not surpassing distal margin of proximal abdominal tergite, or a single fold structure if at all but faintly longer. Dorsum of abdomen in both sexes with caudo-lateral angles of most of the tergites not at all produced: dorsum of male abdomen with a complicated and specifically characteristic specialization of the proximal tergites, the basic characteric of of each so developed being a transverse lamellato-carination. Ultimate tergite (supra-anal plate) of male inter-cercally trigonal with immediate apex narrowly emarginate; of female trigonal. Ultimate sternite (subgenital plate) of male moderately to appreciably asymmetrical, styles simple, conical. Cephalic femora with ventro-cephalic margin bearing in usual position a regular series of strong spines of even disposition, increasing in length proximad and distad passing into a distal group of three apical spines of progressively increasing length; ventral margins of median and caudal femora regularly and strongly spined. Caudal tarsi with metatarsus slightly longer than other articles combined; metatarsus biseriately spinulose ventrad; all tarsal articles bearing distinct apical pulvilli; tarsal claws equal in length, internal margins simple; arolia quite large.

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[38] The only fully alate individual I have seen is a male; all the females before me are brachypterous. The female sex in one of the species, however, is said to be fully alate, but I am otherwise unacquainted with this condition in that sex.

[39] I have examined but a single fully alate specimen and a larger series may show incomplete rami present.

GENOTYPE.—*M. nana* new species.

Key to Species

(Based chiefly on male sex.)

1. Dorsum of abdomen of male with tergal specialization present on all tergites from one to seven inclusive. Tegmina and wings of male reaching to, or virtually to, apex of abdomen. (Pronotum and tegmina basically ochraceous.) *strigata* (Blanchard)

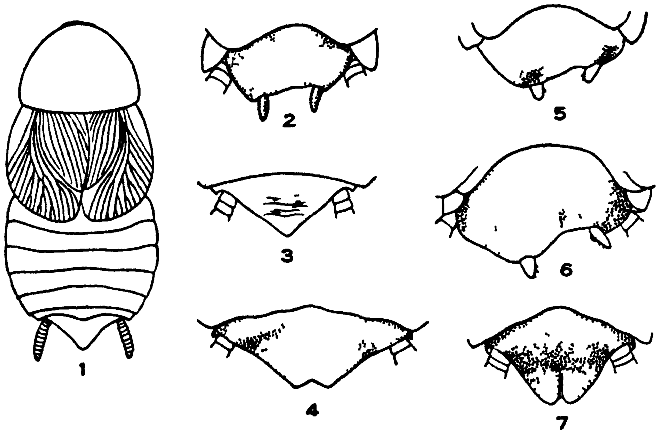
   Dorsum of abdomen of male with tergal specialization involving no more than the three proximal tergites. Tegmina and wings of male abbreviate, covering but proximal portion of abdominal dorsum and hardly, if at all, longer than pronotum, margin rounded or subtruncate distad......2

2. Dorsum of abdomen of male with specialization involving more than a single (*i.e.* proximal) tergite. Tegmina of male with margin arcuate disto-laterad. (Coloration either with head, pronotum, tegmina and limbs ochraceous or as a whole dark fuscous brown.)..................3

   Dorsum of abdomen of male with specialization involving only the proximal tergite. Tegmina of male transversely truncate distad. (Coloration as a whole dark fuscous brown.).................... ....*brevipennis* (Saussure)

3. Size smaller (body of male, 10.8 mm.). Head, pronotum, tegmina and limbs ochraceous; abdominal tergites largely bordered with ochraceous. Strongly developed specialization of abdominal tergites of male involving only the proximal two.......................*nana* new species

Size larger (body of male, 13.9 mm.). Coloration almost entirely dark fuscous brown. Specialization of abdominal tergites of male involving the three proximal ones, showing merely relatively low and weak transverse ridges on the third................*castanea* (Blanchard)



(All except fig. 1 are greatly enlarged.)

Fig. 1.—*Moluchia castanea* (Blanchard), ♀, Talcahuano, Chile, dorsal view, × 3.

Fig. 2—*M. strigata* (Blanchard), ♂, Valparaiso Province, Chile, ventral view of ultimate sternite (subgenital plate).

Fig 3.—*M. strigata*, ♀, Valparaiso Province, Chile, dorsal view of ultimate tergite (supra-anal plate).

Fig. 4.—*M. nana* new species, ♂ (type), Angol, Chile, dorsal view of ultimate tergite (supra-anal plate).

Fig 5.—*M. nana*, ♂ (type), Angol, Chile, ventral view of ultimate sternite (subgenital plate).

Fig. 6.—*M. castanea*, ♂, Chillan, Chile, ventral view of ultimate sternite (subgenital plate).

Fig. 7.—*M. castanea*, ♂, Chillan, Chile, dorsal view of ultimate tergite (supra-anal plate).

Moluchia strigata (Blanchard) (Text-figs. 2 and 3; plate IX, figs. 11–13.)

1851. *Blatta strigata* Blanchard, in Gay, Hist. Fis. y Polit. Chile, Zool., VI, p. 17, Orth. pl. 1, fig. 4. [♀;[40] Chile.]

Valparaiso Province; (A. Faz); one male, two females; [Cornell University].

The figure given by Blanchard cannot be interpreted too literally, as it is greatly conventionalized in form and the coloration is not truthful. The original description with the subsequent one of the type by Saussure (vide infra) give a clearer idea of the species, although the really striking specialization of the male abdomen was not known to either Blanchard or Saussure, the type being a female. Saussure's description fully agrees in ambisexual characters with the male now before me, except that the pronotum and tegmina of the male are slightly smaller, as is to be expected, the lower face is more solidly rufescent and the alar costal veins total eight instead of six. The rather distinctive abdominal coloration described by Saussure is well indicated.

The females I have referred to *strigata* differ markedly from the male in their abbreviate rounded tegmina, which are not more than half as long as the abdomen. Saussure described the type female of *strigata* as having the tegmina approximately equal to the abdomen in length, as in the male now in hand. I have very carefully examined the females and my conclusion is that the species varies in the degree of development of the alar appendages of that sex. The future, however, may show this is an erroneous assumption, and that the females here examined are not true *strigata*. Allowing for the probably occurrence together of these females and the very definitely *strigata* male, the present course seems most advisable.

The specialization of the abdomen of the male now in hand can be described as follows:

Dorsum of abdomen with proximal tergite transversely, sharply and narrowly excavate cephalad, the sinuately delimited chamber extending ventrocephalad beneath the metanotum, mesad both surfaces (*i.e.* of metanotum and of proximal tergite) of chamber are heavily supplied with dense marginal fringes of hairs, which completely screen in that section of the pocket-like slit; caudal margin of chamber symmetrically bisinuate, with a median trigonal production, the dorsal surface of which is clothed with closely adpressed, cephalad directed short hairs; surface of proximal tergite caudad of chamber with two transversely disposed, striking welt-like carinations, one, the more cephalic, consisting of a pair of short, well separated, in transverse outline arcuate, lobes; the more caudal is a much more extensive, similarly paired, elevation of the caudal margin, becoming obsolete laterad and more narrowly separated on the median line: second, third and fourth tergites each with two transversely disposed sets of elevations, similar in position and general disposition to those of proximal tergite but with the cephalic more extensive laterad and becoming more approximate mesad, and finally continuous as a single carination on the fourth tergite, also lower and less welt-like, more truly lamellato-carinate; more caudal elevation of each of these tergites similarly becoming more lamellato-carinate, more extensive laterad and continuous mesad: tergites five to seven with the more caudal of the two transverse carinations becoming progressively lower and less evident, and on the seventh virtually absent; the more cephalic is progressively lower and merely carinate but uniform in elevation on each tergite and still distinctly evident on the seventh; a definite but low medio-longitudinal carination is indicated on the sixth and seventh tergites: eighth tergite very narrowly evident, strongly transverse; ninth tergite narrow, but with caudo-lateral angles moderately acute produced: ultimate tergite (supra-anal plate) moderately transverse proximad, trigonal produced meso-caudad, immediate apex narrowly and shallowly obtuse-angulate emarginate, a definite but shallow medio-longitudinal sulcation extending proximad from apex, and across which proximad is placed a transverse, strongly and narrowly elliptical subexcavate area. Cerci stockily fusiform, in length about one and three-fifth times that of ultimate tergite, apex blunted acute, composed of eleven evident articles, as a whole subdeplanate. Ultimate sternite (subgenital plate) moderately asymmetrical, peripheral margin as a whole subarcuate, interstylar portion shallowly emarginate, inclining toward sinistral side; styles simple, bluntly tapering, subequal in length and build, well separated, slightly asymmetrical in insertion, their dorsal surfaces with numerous brief spinulations.

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[40] Sex not specified in original description. Said to be a female by Saussure (Miss. Scient. du Mexiq., Rech. Zool., VI, p. 41, (1870)), who redescribed the type.

The specimens before me measure (in millimeters) as follows:

	Length of body	Length of pronotum	Greatest width of pronotum	Length of tegmen	Greatest width of tegmen
♂	14.	4.1	5.4	11.5	4.5
♀	12.8	4.5	6.	5.7	4.1
♀	—[41]	4.9	6.1	6.9	4.4

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[41] Abdomen missing.

The only previous records of the species are of its occurrence at Llico, Arauco Province (Philippi) and on Pascua or Rapa-nui Island, ten miles from the coast near Caldera, Atacama Province (Fuentes[42]).

Moluchia nana new species (Text-figs. 4 and 5; pl. IX, figs. 14 and 15.)

This very diminutive species is related to both *M. castanea* and *brevipennis*. It, however, can at once be distinguished from both of its allies by the smaller size, the strikingly bicolored pattern and the specialization of the male abdomen involving the two proximal tergites, instead of the three proximal or merely the first proximal as in *castanea* and *brevipennis* respectively.

Type.—♂; Angol, Malleco Province, Chile. November 12, 1929. (D. S. Bullock.) [Academy of Natural Sciences of Philadelphia, Type no. 5524.]

Size small (for genus); form brachypterous.

Head broad pyriform, somewhat crushed across the occipital region in the type, but faintly deeper than width across eyes; occipital interspace between eyes very broad, nearly equal to half the total width across eyes; interspace between internal margins of antennal scrobes broad, equal to four-fifths that at occiput between eyes: palpi damaged: antennae incomplete.

Pronotum of the general character found in other species of the genus, in the type somewhat crushed on each side; caudal margin arcuato-truncate.

Tegmina reaching as far caudad as the third abdominal tergite, greatest width contained about one and four-fifth times in greatest length of same; costal margin in proximal half nearly straight, thence distad broadly and regularly arcuate, passing evenly into the restricted distal margin, the disto-sutural angle of which is narrowly rounded, sutural margin nearly straight: marginal field short, broad, occupying very faintly more than half the tegminal length; anal field occupying slightly more than two-thirds the length of the sutural margin of the tegmina: costal veins seven to nine in number, including bifurcations; brief discoidal rami of the distal fourth longitudinal in trend; axillary veins at least six in number. Wings merely single-folded rudiments, in length slightly more than half that of tegmina; venation merely a few longitudinal veins.

Dorsum of abdomen with proximal tergite having the glandular specialization indicated as a transverse brace-shaped excavation on cephalic section of tergite, latero-cephalad extending beneath the overhanging margin of the metanotum, the greater (central) portion of the concavity closely clothed with caudo-mesad directed, largely adpressed hairs; concavity bounded distad by the usual paired, markedly elevated and sigmoid lamellate carinae, which are distinctly separated by a narrow but marked concavity from the simple distal margin of the tergite, the dorsal edge of the carinae reflexed caudad as a narrow rim, the carinae separated mesad by a proximad directed, short, depressed, rounded linguiform production, the dorsal surface of which is covered with adpressed, chaetiform hairs, faintly radiating in disposition; second tergite with a pair of brief lamellato-carinations, less extensive and not as sigmoid as on the proximal tergite, and without the recurved margins, these carinae more distant proportionately from the distal margin and separated mesad by a medio-longitudinal subtectate swelling; third and succeeding tergites without elevated carinations or median tectations; ultimate tergite (supra-anal plate) with the intercercal portion trigonal, the converging lateral margins straight, the immediate apex briefly rectangulate emarginate, surface of inter-cercal portion moderately declivent and gently concave. Cerci damaged. Ultimate sternite (subgenital plate) asymmetrical, dextral side of margin nearly straight oblique, sinistral side shorter and distinctly arcuate: styles asymmetrically disposed, the dextral nearly median in position and at apex of sternite, the sinistral separated from the dextral by a moderately arcuate concavity, which sigmoidally passes into the sinistral lateral margin; styles simple, short, of nearly equal length but dextral is heavier and more conical, dorsal surface of each with several adpressed elongate spiniform points, those of dextral style heavier and more evident.

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[42] Bol. Mus. Nac. Chile, VII, p. 313, (1914).

Limbs missing.

Allotype.— ♀ ; Angol, Malleco Province, Chile. November 12, 1929. (D. S. Bullock.) [Academy of Natural Sciences of Philadelphia.]

Differing from the description of the type in the following noteworthy respects:

Size somewhat larger than in male. Interspace between internal margins of antennal scrobes but faintly narrower than that of the interocular section of the occiput.

Pronotum semi-ovate in outline, with greatest width (caudad) equal to one and three-tenth times the greatest length of the same; lateral and cephalic margins nearly regularly arcuate, latero-cephalic angles hardly indicated; caudo-lateral angles narrowly rounded, passing into the broad arcuato-truncate caudal margin: in transverse section the pronotum is evenly arcuate, more decurved latero-cephalad.

Tegmina as in male but proportionately shorter and broader, greatest width equal to one and seven-twentieth times greatest length of same, distal margin more truly transverse truncate than in male: anal field short and broad pyriform.

Abdominal tergites simple: ultimate tergite (supra-anal plate) trigonal: ultimate sternite (subgenital plate) broad, transverse, distal margin obtusely arcuate: cerci relatively short, robust, styliform, moderately tapering in distal half, apex relatively blunt acute, dorsal surface subdeplanate, composed of at least nine articles.

Ventro-cephalic margin of the cephalic femora with the more distal marginal spines largely quite short, the proximal large ones five in number, the distal group of three spines increasing in length distad; ventro-caudal margin with three spaced spines in the distal half. Caudal tarsi with metatarsus but faintly longer than the remaining tarsal articles (as 43 to 41).

Coloration.—General color of head, pronotum, tegmina, wings and limbs ochraceous-buff deepening in areas to pale cinnamon-brown; general color of abdomen solid fuscous black (female) or fuscous varied with orange-ochraceous and hazel (male). Head with a large interocular-interocellar cloud of kaiser brown, as well as an infra-antennal chevron of the same on the lower face, in the male but faint traces of this whole pattern are to be seen: eyes fuscous black: antennae distad of the pale two proximal articles, russet (♂) to mars brown (♀). Pronotum in the female with a distinct balanced pattern of cinnamon-brown, virtually obsolete in the male. Tegmina of female with anal and discoidal fields washed with pale tawny, less evident in male, passing evenly to the pale costal region. Dorsum of male abdomen with tergites one to seven narrowly edged distad and laterad with orange-ochraceous, elsewhere dull fuscous; ventrad the sternites of the male are largely hazel, intermarginally laterad and more weakly transversely barred with fuscous. Limbs with coxae intermarginally finely pencilled with fuscous; caudal tibiae markedly washed with fuscous except on flexor (narrowly) and extensor surfaces; median tibiae weakly touched with same; caudal tarsi washed with pale fuscous: tibial spines cinnamon-rufous.

Measurements (in millimeters)

	Length of body	Length of pronotum	Greatest width of pronotum	Length of tegmen	Greatest width of tegmen
♂, Angol, *type*............	10.8	3.36	—	5.25	2.91
♀, Angol, *allotype*.........	10.3	3.44	4.42	3.94	2.91

The type and allotype are the only specimens I have seen. The type unfortunately is damaged, but its most important features have not been injured seriously.

Moluchia castanea (Blanchard) (Text-figs. 1, 6 and 7; pl. IX, figs. 16 and 17.)

1851. *Kakerlac castanea* Blanchard, in Gay, Hist. Fis. y Polit. Chile, Zool., vi, p. 18, Orth. pl. 1, fig. 2. [♂ (not ♀); Santa Rosa and Coquimbo, Chile.]

Chillan, Nuble Province; December, 1903; (Carlos S. Reed); one male; A.N.S.P.].

Talcahuano, Concepcion Province; December, 1903; (Carlos S. Reed); one female; [A.N.S.P.].

Nos, Santiago Province; 1911; (C. E. Porter); two females; [Paris Museum].

A careful examination of Blanchard's description and figure of *castanea* shows conclusively that the male and female referred by him to that species are appreciably different in size and in the character of the tegmina. The male, which is the sex figured, and to which I therefore restrict the name, is well exemplified by the Chillan individual now in hand. The described female is distinctly larger (i.e. 9 lines in body length) and has lateral, non-attingent, very narrow tegmina, something which I have not seen in this or any other native Chilean blattid genus. As the female sex is said in Blanchard's description of the genus *Kakerlac*, of which *castanea* is the sole species treated by him, to have the ultimate sternite (subgenital plate) valvate, which is not a character of females of the subfamily Pseudomopinae, but is of the Blattinae, I am strongly of the opinion that the female associated with the very different male of *castanea* was merely an individual of that sex of the widely distributed *Blatta orientalis*. Blanchard says *castanea* "es muy vecino del *K. orientalis* de Europa, pero se distingue fácilmente por sus elytros mucho mas cortos en los machos y de forma muy diferente." Nothing is said concerning the female differences, and I am convinced he erroneously associated sexes of very different genera.

The character of specialization of the male abdomen and the terminal plates, drawn from the Chillan male, are as follows:

Proximal tergite with excavate area proportionately large, embracing two-thirds of the length of the tergite, but in width not involving more than median half of same, shallow longitudinal depressions cutting off the lateral sections of the tergite from the latero-cephalic arcuate elevated rim of the central glandular depression, which is apparently divided in two by a low ridge, from which and the encircling borders dense masses of hairs converge to two lateral central points, completely hiding the surface of the paired impressions; immediate caudad of the glandular depression the usual pair of lamellato-carinations sharply cut off the more caudal section of the surface of the tergite, forming transverse shallow gutters between the carinations and the somewhat up curved caudal margin of the tergite, the transverse carinations becoming obsolete laterad, and mesad completely separated by a shallowly impressed area which possesses a low medio-longitudinal tectate ridge. Second tergite with a pair of short, submammillate lamellato-carinations, well separated mesad by a continuation of the medio-longitudinal tectation. Third tergite with the paired analogs of the carinations merely brief rounded, transversely disposed bosses, but with the median tectation equally indicated, thence distad the latter is increasingly less evident, so that no trace is seen distad of the sixth tergite.

Ultimate tergite (supra-anal plate) with intercercal portion trigonal in outline, the disto-lateral sections of the margin convergent, nearly straight oblique, the immediate apex briefly but acutely emarginate, from which extends proximad a shallow medio-longitudinal sulcus, which does not reach the base of the tergite but terminates in a longitudinally disposed and shallow expansion of the sulcus; surface of intercercal portion of ultimate tergite concave, leaving a broad proximal arcuate portion with the usual contour of this tergite: cerci robust, stocky, largely of uniform width, narrowing weakly proximad and briefly blunt acute at apex, composed of nine to ten articles, according to the segmentation. Ultimate sternite (subgenital plate) with proximal sections of outline, as seen from venter, straight longitudinal, thence to most distal point (mesad) the dextral section of the distal margin is straight oblique, the short, conical dextral style situated at the most distal point, thence sinistrad the margin is oblique concave, the sinistral style, which is of equal length but more slender than the dextral, placed ventrad of internal side of base of sinistral cercus; sinistral portion of margin oblique subarcuate; dorsal surface of both styles with a few adpressed dentiform spines.

Measurements (in millimeters)

	Length of body	Length of pronotum	Greatest width of pronotum	Length of tegmen	Greatest width of tegmen
♂, Chillan	13.9	3.69	4.87	4.87	2.91
♀, Talcahuano	14.	4.2	5.54	4.87	3.69
♀, Nos	12.2	5.03	5.46	4.45	3.19
♀, Nos	—	4.2	5.46	4.62	3.78

Moluchia brevipennis (Saussure) (Pl. IX, figs. 18 and 19.)

1864. *Ischnoptera brevipennis* Saussure, Rev. et Mag. de Zool., 2e ser., xvi, p. 313. [♀; Chile.]

Valparaiso Province; (A. Faz); one male; [Cornell University].

This species was described in greater detail and figured by Saussure subsequent to the original description.[43] Some years later the same author published further comments on the type,[44] showing that the original measurements were too great, the abdomen of the specimen have been abnormally extended. At the same time he also briefly described the male sex.

I am convinced the species recorded by Philippi[45] as *Kakerlac castanea* Blanchard is the present one, and not true *castanea*. The comments made by Philippi relative to the proportions and shape of the tegmina clearly indicate this.

The features of the tegmina and of the abdominal specialization of the male in hand are as follows:

Tegmina subquadrate, but faintly longer than the pronotum, greatest width equal to about four-fifths of length, in longitudinal extent the tegmina cover not more than the proximal third of abdomen; their distal margin truncate, disto-costal margin well rounded, disto-sutural margin narrowly rounded; anal sulcus joining sutural margin at two-thirds of length from base. Wings abbreviate and articulate, not surpassing distal margin of proximal abdominal tergite.

Proximal abdominal tergite with excavate area narrow, transverse and proximal, extending beneath caudal section of metanotum, deeper laterad of a median dividing area, toward which the adpressed hair vesture of the depression converges; immediately caudad of the depressed area the proximal tergite shows a pair of relatively low transverse subsinuate, subinflated carinato-lamellations, which become obsolete laterad, and mesad are well separated by an extension of the excavate area reaching to the distal margin of the tergite. Second and succeeding tergites without glandular specialization or marked lamellate transverse ridges. Ultimate tergite (supra-anal plate) with intercercal section trigonal in outline, declivent distad, the surface of this section with numerous closely placed transverse striations, a low medio-longitudinal impressed line also indicated; converging distal portions of margins somewhat thickened, straight oblique, immediate apex distinctly but briefly subtransverse concavo-emarginate, lateral points of the thickened margin each bearing one or more spiniform chaetae. Cerci damaged. Ultimate sternite (subgenital plate) but faintly asymmetrical, sinistral converging arcuation of same and the juxta-stylar angulation of the same side more pronounced than is true of the dextral side; interstylar (median) section of margin of sternite straight transverse as seen from venter; styles well separated, inserted in sockets of virtually symmetrical disposition, simple, tapering, apex subacute, the sinistral faintly longer than dextral, internal surfaces with numerous short dentiform spinulations.

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[43] Mém. Hist. Nat. Mex., III, p. 80, pl. 1, fig. 11, (1864).

[44] Miss. Scient. Mex., Rech. Zool., VI, p. 23, (1870).

[45] Zeitschr. Gesammt. Naturw., XXI, p. 221, (1863).

The above described male measures as follows: length of body, 13.8 mm.; length of pronotum, 4.03; greatest width of pronotum, 5.71; length of tegmen, 4.36; greatest width of tegmen, 3.61.

None of the references to this species by Saussure supply any detailed distributional data. Blanchard's record of *castanea*, which I am certain really refers to this present species, gives it as occurring in houses in Santiago. Whether this genus is actually domiciliary in its habits requires confirmation.

BLATTINAE

Blatta orientalis Linnaeus

1758. [*Blatta*] *orientalis* Linnaeus, Syst. Nat., x ed., p. 424. [America; the East; Russia; Stockholm, Sweden; Finland.]

1863. *K*[*akerlac*] *platystetho* Philippi, Zeitschr. Gesammt. Naturw., xxi, p. 222. [♂; Chile.[46]]

1863. *K*[*akerlac*] *pallipes* Philippi, Zeitschr. Gesammt. Naturw., xxi, p. 222. [♀; Santiago, Chile.]

Concepcion; (Carlos S. Reed); one female; [A.N.S.P.].

Angol, Malleco Province; September 24 and October 25, 1929; (D. S. Bullock); one male, one female; [A.N.S.P.].

Maipú; (F. V. Ibarro); one immature male, one immature female; [Hebard Cln.].

The synonymy established above is clearly evident from a study of Philippi's descriptions. Apparently he failed to compare his specimens with either material or descriptions of this cosmopolitan species. The name *platystetho* is based on a normally sized male, *pallipes* on a rather small, possibly teneral female, which was paler in color than individuals fully hardened in life. In addition

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[46] Philippi says "Unicum specimen inter copiam anterioris inveni; ni fallor sub lapidibus in radice Andium captum." There can be little question the specimen was taken in or about habitations.

I feel the specimen described as the female of *Kakerlac castanea* by Blanchard (see above under *Moluchia castanea*) represented the present circumorbital species.

PERISPHAERINAE

Parasphaeria ovata (Blanchard)

1851. *Blatta ovata* Blanchard, in Gay, Hist. Fis. y Polit. de Chile, Zool., vi, p. 14, Orth. pl. 1, fig. 3. [♂, Chile.]

1862. *H*[*ormetica*] *chilensis* Saussure, Rev. de Mag. de Zool., ser. 2, xiv, p.233. [Juv.; Chile.]

1863. *P*[*olyzosteria*] *valdiviana* Philippi, Zeitschr. Gesammt. Naturw., xxi, p. 223. [♂,[47] ♀; Valdivia, Chile.]

1863. *P*[*olyzosteria*] *geissei* Philippi, Zeitschr. Gesammt. Naturw., xxi, p. 225. [Juv.; Puerto Montt, Chile.]

Aucud, Chiloe Island; April 2 to 7, 1920; (Cornell Exped.); one female; [Cornell University].

The synonymy given above was established years ago by Brunner and Saussure, and is apparently correct.

This very remarkable genus and species has also been recorded from the Valley of Marga-Marga, Chile,[48] while Shelford reports the same species from Santo Domingo de los Colorados, Ecuador, at an elevation of 510 meters.[49] I cannot refrain from querying the determination of the latter specimen as the locality in question is a truly tropical one.[50] While I have seen no Blattidae from that point, I have from there material of a number of species of saltatorial Orthoptera, and they are in every way truly representative of a fauna which would hardly include a species elsewhere characteristic of the temperate southern portion of Chile. Probably the unique male specimen examined by Shelford belongs to one of the numerous other superficially similar genera of Perisphaerinae, now known to occur in the tropical and subtropical zones of the countries of northwest and northern South America and Central America, such as *Colaptero-*

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[47] The male described may have had the alar organs damaged. The tegmina are said to be short, but in the male of *ovata* they are fully developed.

[48] Edwards, Rev. Chilena, i, 2, p. 22, (1897).

[49] Miss. Geogr. Arc Mérid. Equat., x, fasc. 1, p. 59, (1913).

[50] This locality is on the Machachi-Bahia trail near the Rio Toachi, about 55 kilometers due west of Quito in the foothills of the Western Andes. It is said by Chapman (Dist. Bird-life in Ecuador, p. 719) to be in humid tropical forest.

blatta, *Poroblatta*, *Acroporoblatta*, *Litopeltis* and *Antioquita* Hebard, and *Cariacasia* and *Nauclidas* Rehn. The males of these have a general resemblance to that sex of *Parasphaeria*, but are distinguished by many details of structure.

It would thus seem, from the information now available, that *Parasphaeria ovata* is limited in distribution to the southern half of Chile.

EXPLANATION OF PLATE IX

Fig. 1.—*Phidon bullocki* new species. Male (type). Angol, Chile. Dorsal view of pronotum. (× 6.)

Fig. 2.—*Phidon bullocki* new species. Male (type). Angol, Chile. Lateral view of ultimate sternite (sub-genital plate) showing dextral style. (Greatly enlarged.)

Fig. 3.—*Phidon bullocki* new species. Male (type). Angol Chile. Dorsal view of distal portion of abdomen. (Much enlarged.)

Fig. 4.—*Phidon bullocki* new species. Male (type). Angol, Chile. Outline of left tegmen. (× 4.)

Fig. 5.—*Phidon reticularis* (Blanchard). Male. Concepcion, Chile. Dorsal view of pronotum. (× 6.)

Fig. 6.—*Phidon reticularis* (Blanchard). Male. Concepcion, Chile. Lateral view of ultimate sternite (subgenital plate) showing dextral style. (Greatly enlarged.)

Fig. 7.—*Phidon reticularis* (Blanchard). Male. Concepcion, Chile. Outline of left tegmen. (× 4.)

Fig. 8.—*Phidon araucanus* new species. Male (type). Chile. Dorsal view of pronotum. (× 6.)

Fig. 9.—*Phidon araucanus* new species. Male (type). Chile. Lateral view of ultimate sternite (subgenital plate) showing dextral style. (Greatly enlarged.)

Fig. 10.—*Phidon araucanus* new species. Male (type). Chile. Outline of left tegmen. (× 4.)

Fig. 11.—*Moluchia strigata* (Blanchard). Male. Valparaiso Province, Chile. Dorsal view of abdomen. (× 3.)

Fig. 12.—*Moluchia strigata* (Blanchard). Male. Valparaiso Province, Chile. Outline of left tegmen. (× 3.)

Fig. 13.—*Moluchia strigata* (Blanchard). Female. Valparaiso Province, Chile. Outline of left tegmen. (× 3.)

Fig. 14.—*Moluchia nana* new species. Male (type). Angol, Chile. Dorsal view of base of abdomen. (Much enlarged.)

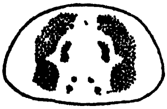
Fig. 15.—*Moluchia nana* new species. Male (type). Angol, Chile. Outline of left tegmen. (× 3.)

Fig. 16.—*Moluchia castanea* (Blanchard). Male. Chillan, Chile. Dorsal view of base of abdomen. (Much enlarged.)

Fig. 17.—*Moluchia castanea* (Blanchard). Male. Chillan, Chile. Outline of left tegmen. (× 3.)

Fig. 18.—*Moluchia brevipennis* (Saussure). Male. Valparaiso Province, Chile. Dorsal view of base of abdomen. (Much enlarged.)

Fig. 19.—*Moluchia brevipennis* (Saussure). Male. Valparaiso Province, Chile. Outline of left tegmen. (× 3.)



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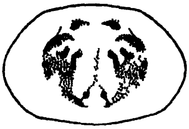

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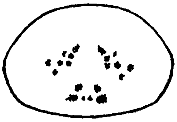

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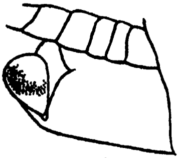

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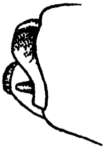

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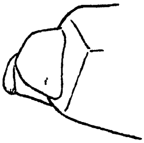

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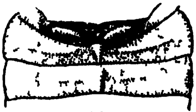

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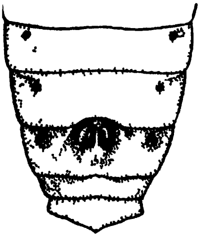

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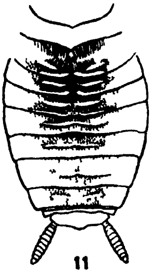

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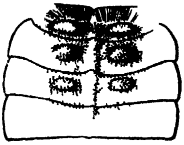

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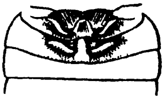

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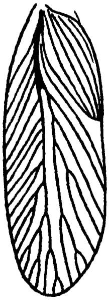

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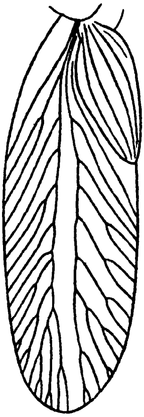

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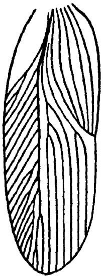

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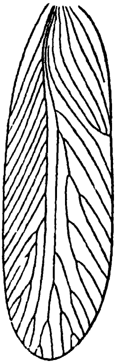

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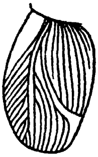

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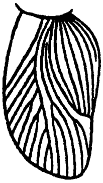

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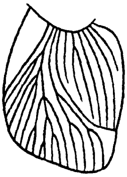

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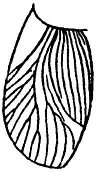

15

REHN—DERMAPTERA AND ORTHOPTERA OF CHILE

STUDIES IN THE TENEBRIONIDAE, No. III.[1]

(COLEOPTERA)

BY FRANK E. BLAISDELL, SR.

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The present paper contains the descriptions of a number of nondescripts that have been in my collection for many years awaiting other specimens or the opposite sexes. As no such acquisitions have been forthcoming for the most part, it is thought best to make known the species and in that way stimulate greater interest in their discovery and collection.

I wish to express my appreciation and gratitude for the loan of material and aid given me by the following persons and Institutions: Mr. E. T. Cresson, Jr. of The Academy of Natural Sciences of Philadelphia, for specimens from the collection of the American Entomological Society, especially from the collection of Dr. Geo. Horn; Mr. Nathan Banks of the Entomological Department of the Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, for comparisons of specimens with types of LeConte; Mr. Roy E. Wagner of Fresno, California, for loan of his excellent material and for calling my attention to very important facts; Mr. Chas. Liebeck, of Philadelphia, and Mr. Henry Drietrich of the New York State College of Agriculture, Department of Entomology, Cornell University at Ithaca, for loan of material. The series in the Museum of the California Academy of Sciences includes the collections of Dr. E. C. Van Dyke, J. O. Martin and that of the author.

Euschides cressoni new species

Form rather robust, elongate oval, a little more than twice as long as wide; pronotum obtusely angulate laterally as in *angulatus* Lec., body subcylindrical. Color deep black, integuments very smooth and shining; luster of head and pronotum somewhat dull.

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[1] No. 1. Ent. News, XXLX, pp. 162–169, (May, 1913). No. 2. Proc. Calif. Acad. Sciences, 4th S., XIV, pp. 369–390, (Sept. 18, 1925).

Head about as long as wide with labrum extended, or twice as wide as long from the post-ocular line to epistomal apex, about a fourth narrower than the pronotal apex; widest before the eyes, supra-antennal convexities strong, arcuately prominent laterally, thence the sides rapidly convergent and broadly sinuate to the obtusely rounded epistomal angles; surface deeply, strongly and transversely impressed at epistomal base and within the supra-antennal prominences, epistoma correspondingly convex; vertex moderately convex, frons quite plane, gradually declivous to the impression, punctures distinct, small, separated by a distance equal to one to three times their diameter, vertex impunctate. Labrum about two fifths as wide as the head, arcuate laterally, angles continuously so, apex broadly, arcuately and rather deeply emarginate at middle. Antennae slender, compressed apically, one-half longer than width of head and attains basal fourth of the pronotum; second segment short and as wide as long, third twice as long as second, third to eighth inclusive elongate and not incrassate; fourth and fifth equal in length, a little shorter than third; sixth, seventh and eighth subequal, very slightly increased in thickness and a third shorter than fifth; ninth segment a little longer than wide, one-half as long as the third, distinctly thickened, tenth triangular, quite abruptly broader, a third wider than ninth, about as wide as long, eleventh small, circular and about half as wide as the tenth.

Pronotum one-half wider than long, broadly and obtusely angulate laterally, widest slightly behind the middle, length equal to the apex; the latter deeply and arcuately emarginate, angles acute, triangular and prominent anteriorly, margin finely beaded; sides broadly, arcuately obtuse at middle, thence convergent and broadly, feebly sinuate anteriorly to the angles, posteriorly arcuately declivous and convergent to the rather feeble obtuse basal angles, margins most widely impressed but not broadly so in middle third, decreasingly so toward the angles, moderately reflexed, beads rather coarse and finely crenulate, entire and fine on the declivity to base; the latter a little wider than apex, feebly lobed and slightly sinuate in middle third opposite to the scutellum, laterally slightly oblique and feebly sinuate to the angles, not beaded; disk very strongly convex, subgibbous across basal third, gradually less so anteriorly, arcuately precipitous in basal fifth, a strong semilunar impression at middle against the base, surface smooth, not sculptured laterally, a few sparse and coarse punctures in the impressed area, elsewhere obsoletely punctulate.

Elytra oval, about a third longer than wide, base feebly emarginate, as wide as the pronotal base, humeri small and subacute, not prominent; sides broadly, moderately and evenly arcuate to the rather broadly rounded apex; disk evenly, strongly and subcylindrically convex from side to side, the arcuate apical declivity but slightly oblique, post-humeral margin but slightly more abruptly convex; surface impunctate, very obsoletely reticulate along strial lines and intervals; apices not in the least swollen. Scutellum triangular, small and impunctate.

Propleurae rather irregularly convex, very sparsely punctate, punctures small, surface more or less rugose against and on the reflexed margins and coxal convexities; prosternum sparsely punctate. Mesosternum and side pieces finely but not closely punctate. Metasternum and parapleural region obsoletely punctate.

Abdomen moderately strongly convex, surface dull and extremely finely, microscopically crinkled to appear granulate, obsoletely reticulate, slightly rugose on base of the first three segments, punctures not discernable. First segment on the median line twice as long as the third, second about twice as long as the fourth, third equal to the fifth.

Legs moderately long, likewise slender; femora polished and transversely rugose; tibiae densely but not coarsely sculptured; punctures with short setae, tarsi stout. Metatibiae two and a fourth times as long as their tarsi.

Measurements.—Length 25 mm.; width 11 mm.

Holotype.—Female. It was collected by James A. G. Rehn at Wagon Pass, eight miles east of Jacumba, San Diego County, Calif., at an elevation of 3700 ft., Sept. 15, 1922. [No. 8167, in the collection of The Academy of Natural Sciences of Philadelphia.]

The species is dedicated to E. T. Cresson, Jr., in appreciation of aid given me in my research.

Cressoni is a very distinct species related to *angulatus* Lec. by its obtusely angulate sides of the pronotum. It differs markedly by its more convex, subgibbous and more posteriorly precipitous pronotum and strong semilunar basal impression; the color is of a deep black, surface smoother and more shining, punctulation very fine and more or less obsolete. Side margins of the pronotum noticeably reflexed and the marginal bead coarser; tenth antennal segment quite equilaterally triangular and as long as wide and the eleventh is small and circular (female); the elytra are more convex, more broadly rounded at apex and more rapidly declivous apically, not gradually narrowed as in *angulatus* Lec. Abdomen densely alutaceous and extremely finely crinkled and subgranulate.

In *angulatus* the tenth antennal segment is transverse, not equilaterally triangular in the female and the eleventh segment is larger and not evenly circular. The elytra are less convex and gradually narrowed apically, less so in the female and the punctation is distinct; pronotum less convex, less precipitous posteriorly and not impressed at base before the scutellum; surface rather dull and feebly shining. In the male the tenth and eleventh antennal segments are distinctly transverse, the latter very short.

Eleodes omissa Leconte subsp. **tumida** new subspecies

Form ovate, about twice as long as wide, head and prothorax relatively small, elytra more or less inflated. Color deep black, luster dull and more or less alutaceous.

Head about as wide as long, a little more than one-half as wide as the pronotum; eyes and tempora together evenly arcuate; sides rather feebly arcuate over the antennal insertions, thence straight and moderately convergent, obsoletely emarginate at the oblique sutures; epistomal apex broadly and feebly emarginate, angles obtusely rounded, frontal and oblique sutures fine and more or less evident; frons very feebly and evenly convex, epistoma nearly plane, finely and rather irregularly punctate, punctures small, separated by a distance equal to one to four times their diameter. Antennae moderately long, attaining the pronotal base, slender, scarcely thickened externally; second segment very short, as long as wide, third elongate, four times as long as the second and about twice as long as the fourth, the latter slightly longer than the fifth; fifth, sixth and seventh subequal in length, eighth triangular and as long as wide, ninth and tenth more or less irregularly spherical, as long as wide, eleventh ovate and obliquely pointed at apex.

Pronotum more or less subquadrate, widest before the middle, one-eighth to one-fourth wider than long; apex subtruncate in feeble circular arc, angles obtuse and not in the least prominent; sides evenly arcuate in anterior two-thirds, thence convergent, almost straight, feebly and broadly sinuate before the obtuse basal angles; base broadly and moderately arcuate, less so in middle third, a little wider than the apex; disk evenly and moderately convex from side to side, moderately declivous anterolaterally, marginal beads quite evident throughout, the lateral quite visible when viewed vertically from above, sparsely and irregularly punctate, punctures as on the frons, separated by a distance equal to two to six times their diameter.

Elytra different in width in the sexes, strongly convex from side to side, abruptly and arcuately as well as more or less vertically declivous at apex; base slightly wider than the pronotal base, humeral angles distinct and not in the least prominent; sides evenly and rather strongly arcuate, apex rather narrowly rounded; disk very finely, rather closely punctate, punctures equal in size, series are evident.

Abdominal segments sparsely punctate, punctures small in size, surface distinctly, rather coarsely and irregularly creased. Relative lengths of the segments quite similar in the sexes: First about as long as the third and fourth taken together, third as long as the fifth, second about twice as long as the fourth; intercoxal process of first segment sharply truncate at apex and flush with the anterior margin of the coxae. Legs slender, moderate in length; metatarsi elongate, three-fifths as long as their tibiae; plantar grooves of the protarsi open and entire.

Male. Narrower ovate, elytra not strongly inflated, about five-sevenths longer than wide and a little less than three times the length of the pronotum. Abdomen slightly oblique to the sterna, less than moderately convex; first three segments flattened in middle third, a linear impression more or less visible on the median line, sometimes on the fifth; punctures coarser toward base, finer on the fifth, punctation stronger than on the upper surface.

Female. Strongly ovate, elytra inflated. Abdomen evenly and moderately convex, otherwise as in the male.

Measurements.—(Types) Length 15 to 18 mm., width 6.5 to 9.0 mm.

Holotype.—Female. Collected at Bass Lake which is situated a few miles beyond Northfork, Madera County, California, in the Sierras at an altitude of about 4000 ft. Collected by Roy S. Wagner, to whom I am indebted for specimens, which were taken on April 21, 1932. [No. 3707, and *allotype*, male, No. 3708, in the author's collection, Museum of the California Academy of Sciences.]

Paratypes in the author's collection and that of Mr. Wagner, who very kindly allowed me to place one in the collection of The Academy of Natural Sciences of Philadelphia. A moderate series studied.

Tumida is a member of the subgenus *Melaneleodes* and of the *omissa* section which have the inner spur of the protibiae slender and acute, not thickened and obtuse. It resembles *pygmaea* Blais., but the elytra of the female is strongly inflated with the head and pronotum relatively small, the under surface of the body is distinctly and irregularly creased.

Eleodes spoliata new species

Form ovate, about twice as long as wide. Color black, very opaque and alutaceous, sculpture very scabrous, consisting of setigerous punctures raised on small muricate tubercles.

Head a little wider than long, two-thirds as wide as the pronotum and quite as wide as the apex; eyes and tempora equally prominent; sides quite strongly arcuate over the antennal insertions, thence convergent and broadly sinuate to the rounded epistomal angles; epistomal apex broadly and feebly emarginate; labrum transverse apex arcuate with a small rounded sinus at middle; frons feebly convex, supra-antennal convexities rather strong, within which the surface is slightly impressed, the impression extending along the frontal suture, the sutures not distinct, punctures close and raised on muricate asperities, each with a stout, black seta, setae of the labrum rather long and semi-recumbent. Antennae of moderate length, slightly incrassate; second segment very short, about as long as wide, segments three to five inclusive subparallel and feebly obconical; third elongate, about a third longer than the fourth, the latter less than twice as long as wide, fifth, sixth and eighth subequal in length and about a fourth longer than wide, seventh a little longer; eighth subquadrate, ninth and tenth subspherical, as long as wide, eleventh short ovate, somewhat sinuately narrowed and truncate at apex.

Pronotum subquadrate, widest before the middle and about two-sevenths wider than long; sides moderately arcuate in apical half, thence straight and convergent to base, margin finely and irregularly serrulate; apex feebly and broadly emarginate in feeble circular arc, angles obtuse and slightly prominent; base broadly and moderately arcuate, about a seventh wider than the apex, angles obtuse and distinct; disk evenly convex, densely scabrous, setae short and slender, arising from the elevated muricate punctures, marginal beads obsolete.

Elytra oval, not quite one-half longer than wide, widest at middle; base transverse, not margined, humeral angles absent; sides evenly arcuate, apex subacute, sutural angles minutely divergent; disk somewhat depressed and moderately convex, strongly, rather abruptly and arcuately declivous laterally, apical declivity arcuate and oblique, densely scabrous, punctures raised on small muricate tubercles, each with a short seta, viewed longitudinally from behind a linear arrangement is somewhat discernable, strial asperities slightly larger than the interstitial.

Under surface of body more or less shining, sculptured as above but less densely. Abdomen less than moderately convex, impressed along middle third of first three segments and more strongly sculptured, fourth and fifth segments simply sparsely and muricately punctate; first segment on the median line equal in length to the second and third taken together, twice as long as the fifth, third as long as the fifth, second about twice as long as the fourth. Legs moderate in length, quite slender; each tarsus is fimbriate at apex with hairs that are quite as long as the fourth segment. A metatarsus is equal to one-half the length of its tibia; segments two and three equal in length, first a little longer, fourth equal in length to the preceding three taken together; apical hairs subequal in length to the fourth segment.

Measurements.—(Type) Length 12 mm.; width 5.5 mm.

Type.—Male. The unique was collected by F. W. Nunenmacher on May 17, 1913, in Klamath County, Oregon. [No. 3709, in the author's collection, Museum of the California Academy of Sciences.]

The single specimen has been at hand for about nineteen years, waiting for other specimens to be secured. It is a very distinct species and should follow *pilosa* Horn in our lists, as a member of the subgenus *Tricheleodes*. In *spoliata* the body is clothed with short setae and not long hairs as in *pilosa;* in the latter species the pronotum is sculptured with large, shallow and more or less eroded punctures, while in *spoliata* the pronotum is asperate like the elytra, from small setigerous muricate tubercles.

Eleodes armata Leconte var. **pumila** new variety

Form elongate oblong-subfusiform to oblong-ovate, types about one-half the size of average specimens of *armata* Lec., smooth and of slender habitus. Punctation fine and very sparse throughout, except on head and prosternum, where the punctures are larger and much less sparse, simple to feebly muricate. Luster rather dull and moderately alutaceous.

Head as long as wide, feebly convex, almost plane, scarcely prominent over the antennal insertions; sides moderately convergent anteriorly, rather feebly arcuate, most so in front of the eyes, feebly emarginate at the oblique sutures, the latter with the frontal obsolete. Epistomal apex truncate, angles obtusely rounded; frons distinctly punctate, punctures moderately strong and separated by a distance equal to one to three times their diameters. Labrum feebly convex, sides parallel, thence moderately arcuate, with a rounded emargination in middle third of apex. Middle lobe of mentum rather small, truncate at apex; lateral lobes small and exposed. Eyes not in the least prominent, tempora oblique and not convex. Antennae slender, moderate in length attaining the pronotal base, distal four segments slightly incrassate; similar in the sexes, third segment about four times as long as the second, fourth a little longer than the fifth, the latter to the eighth inclusive equal in length, eighth and ninth triangular and about as long as wide; ninth and tenth more or less rounded, eleventh ovate and obliquely truncate at apex.

Propleural punctures with short black setae; prosternal process rather coarsely rugoso-punctate.

Pronotum about a fourth wider than long, apex truncato-emarginate between the acute, moderately prominent, feebly everted apical angles; sides very moderately arcuate in anterior two-thirds, thence straight and convergent to base, the latter slightly arcuate, angles obtuse; base and apex subequal in width and quite equal to the length; apical bead obsolete at middle, the lateral fine, that of the base coarser and flat; disk evenly convex.

Elytra more or less subcylindrically convex, base about equal to that of the pronotum; humeral angles small and sharply obtuse; sides broadly and evenly arcuate to the feebly lobed, obtusely rounded apex; disk arcuately convex from side to side, slightly less so on the dorsum, rather sharply declivous apically.

Legs slender, moderate in length. Femoral teeth small and very acute. Metatarsi a little less than half as long as their tibiae.

Male. Narrower, subcylindrical; elytra about a fourth wider than the pronotum, approximate striae of very small obsolescent punctures, interstitial punctules extremely minute and scattered. Abdomen horizontal with the sterna, less than moderately convex, flattened in middle third of first three segments, somewhat narrowly impressed on the median line of first two segments; first segment on median line as long as second and third together, post-coxal portion about as long as the second and a little longer than the third or fifth; third twice as long as the fourth.

Female. Stouter, ovate, about a half wider than the pronotum. Abdomen evenly convex and horizontal; first segment on the median line not quite as long as the second and third together, second a third longer than the third, the latter about as long as fifth and not quite as long as fourth.

Measurements.—(Types) Length 18.0 to 18.0 mm.; width 6.0 to 7.8 mm.

Holotype.—Female. Collected about twenty miles north-east of El Centro, Imperial County, California. [No. 3710, and allotype, No. 3711, in the author's collection, Museum of the California Academy of Sciences.]

Paratypes in the author's collection and one has been deposited in that of The Academy of Natural Sciences of Philadelphia. A considerable series studied. The largest paratype has the following measurements: length 23 mm.; width 8 mm.

Pumila differs from typical *armata* Lec. in its small size and slender habitus; in part of the paratypes the elytra show faint approximate striae of very small punctures, occasionally the scattered interstitial punctules are equal in size to the strial. *Armata* is much more robust and is always heavier.

Eleodes amedeensis new species

Form elongate, subcylindrical, subfusiform to oblong-subovate, about two and a half times as long as wide. Color dull black, strongly alutaceous with a strong sericeous luster; punctation extremely fine throughout.

Head relatively small, about one-half as wide as the pronotum; frons feebly convex, very broadly and slightly impressed within the feebly convex and rather thick supra-antennal convexities, the latter not more prominent than the eyes, tempora arcuate in continuity with the eyes and feebly developed; sides moderately convergent anteriorly, rather broadly emarginate at the fine oblique sutures. Epistoma short, broadly and feebly sinuate at apex; frontal suture obsolete to very fine; surface finely and irregularly punctate, punctures larger anteriorly and laterally. Labrum slightly transverse, apex with a rounded sinus at middle third, apical half abruptly and very densely punctate, each puncture with a rather short yellowish seta. Eyes very short, relatively small. Middle lobe of the mentum triangulo-trapezoidal, apex arcuato-truncate, sides angulate at middle, thence sinuate anteriorly; lateral lobes very small. Stipes with a distinct process. Antennae similar in the sexes, moderately long and slender, as long as the pronotum; distal segments slightly compressed, not incrassate; second segment short, as long as wide, third about three times as long as second and quite equal to the combined length of fourth and fifth; fifth and seventh segments equal in length and one-half longer than wide, fourth twice as long as wide, sixth and eighth equal in length, ninth subtriangular and as long as wide, ninth and tenth rounded and as long as wide, eleventh rather irregularly ovate.

Pronotum widest at middle, about one-sixth wider than long, apex one-fourth wider than the head, base one-sixth wider than apex and equal to the length; apex feebly arcuate in middle two fourths, thence sinuate within the moderate, prominent, acute and more or less everted dentiform angles, bead fine and obsolete in middle third; sides moderately arcuate in anterior half and sinuate behind the angles, convergent toward base, rather straight, feebly and broadly sinuate before the small, slightly prominent or obtuse basal angles, marginal bead fine and even; base broadly arcuate, bead more or less coarse and flat; disk moderately and almost evenly convex, moderately declivous antero-laterally, punctation sparse and very inconspicuous.

Propleurae smooth and impunctate, except anteriorly where the punctures are distinct, each with a fine appressed hair. Prosternal process distinctly mucronate.

Elytra about three-fifths longer than wide, oval; base transverse, humeral angles small and distinct; sides broadly arcuate, apex obtusely rounded; disk more or less evenly rounded from side to side, somewhat less so in the central area, arcuately and rather abruptly obliquely declivous in apical fourth; punctules very fine, close in approximate and unimpressed strial series, interstitial spaces with an irregular single series.

Abdomen less than moderately convex. Legs somewhat long, rather stout; femora armed, not noticeably clavate and almost parallel, teeth slender and very acute; tibiae somewhat arcuate in basal third, tarsi rather stout; metatibiae two and one-third times longer than a metatarsus.

Male. Narrower, subcylindrical, about equally narrowed anteriorly and posteriorly. Abdomen less than moderately convex, flattened in middle third, more strongly impressed on the median line on first three segments.

Female. More ovate. Elytra somewhat widest at or behind the middle. Abdomen less than moderately convex, less so along middle third.

Measurements.—(Types) Length 24 to 25 mm.; width 9 to 11 mm.

Holotype.—Female. Collected by H. F. Wickham at Amedee, in south-eastern Lassen County, California, July 21, at an elevation of 4200 ft. [No. 3712, and *allotype,* male, No. 3713, in the author's collection, Museum of the California Academy of Sciences.]

Paratypes in the author's collection. One has been deposited in the collection of The Academy of Natural Sciences of Philadelphia.

Distribution.—CALIFORNIA: Eastern part of the State as far south as the Colorado Desert, at Palm Springs, La Puerta, Imperial county; Ahwahnee, Yosemite Valley, May, (A. Fenyes), Mariposa County. NEVADA: Goldfield, Esmeralda County, (F. W. Nunenmacher).

Amedeensis is very distinct from *armata* Lec. in its more cylindrical form, alutaceous and sericeous luster. In *subcylindrica* Casey the form is more robust, anterior pronotal angles large, acute and anteriorly prominent; the middle and posterior femora are mutic. *Armata* Lec. is without an alutaceous luster, its form although variable is generally more or less oblong-ovate.

In my Monograph of the Eleodiini[2] the types of *amedeensis* are mentioned under Habitat as occurring at Amedee, Lassen County. At that time I did not deem it advisable to describe species as new on account of the lack of knowledge of the many variants referrable to the Armata Complex. The twenty-two years that have elapsed since then, have brought much material to my notice and study and has strengthened my conviction that the present species is valid.

Eleodes scabripennis LeConte, Proc. Ac. Nat. Sci. Phila., 1859, p. 77.

Three specimens of this species have rather recently been collected by Mr. E. R. Leach, of Piedmont, Alameda County, California, at the California Hot Springs, Tulare County, California, on June 22, 1928. There has been much speculation and doubt regarding the identity of this species. I have known of only one authentic specimen and that is the type, which I had an opportunity of examining in 1928, while at the Museum of Comparative Zoology in Cambridge, Mass. The specific validity is settled. The following are my notes recorded at the time I made a critical examination of the type: "A female, not roughly sculptured and resembles a *consobrina* Lec. The pronotum is not strongly and evenly arcuate at the sides in *scabripennis,* but has the appearance of being broader in apical third and thence more convergent to base, not strongly constricted as in *consobrina;* in other words, the pronotal sides are less arcuate in anterior two-thirds, convergent and broadly, rather feebly sinuate in basal third before the distinct obtuse angles. The pronotal disk is punctate as in *consobrina* and the elytra are like the smoother phase of that species, the genial angles are the same." The two species, *kaweana* and *scabriventris* described in the present paper are related to *scabripennis* and with it constitute a group distinct from that of *consobrina*. *Scabripennis* is a little more robust and the pronotal characters are different. The name scabripennis is really a misnomer. The type has a gold disk locality label, indicating California; the name is in LeConte's hand writing as well as the locality, "Tejon."

Actual comparisons were subsequently made for me by Mr. Nathan Banks. His comments are as follows: "The type of *E. scabripennis* has the elytral sculpturing as in *consobrina*—in fact extremely close to the specimen of *consobrina* that you have sent. The type of the latter may be a worn specimen as the ridges are less sharp and the pronotum seems to be a little broader than in your specimen. The pronotum of *scabripennis* is not near as broad, nor so much narrowed behind as in *consobrina*."

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[2] Bull. U. S. Nat. Mus. No. 63, p. 261, (1909).

Eleodes scabriventris new species

Form elongate oblong-suboval, less than three times as long as wide. Color deep black, mouth-parts more or less rufo-piceous. Elytral sculpturing not coarse; ventral surface of body throughout densely punctate, punctures rather finely, distinctly muricate and subtuberculose in the central area of the first three abdominal segments.

Head relatively small, about a fifth wider than long; frons nearly plane, very feebly impressed within the rather feeble convexity over the antennal insertions, where the sides are slightly more prominent than the eyes, tempora oblique; frons rather densely and irregularly punctate, punctures moderately small, not coalescent. Middle lobe of the mentum moderate in size and ogival at apex; surface narrowly and longitudinally impressed laterally. Antennae slender, quite equal in length to the pronotal width; outer four segments not thickened; second segment short and as wide as long, third elongate, subcylindrical, equal to the combined length of fourth and fifth, the latter each one-half longer than wide, fourth two-fifths longer than the second; sixth, seventh and eighth subequal in length, about a third longer than wide, fifth to the tenth inclusive of quite equal width, slightly wider than the fourth and fifth; eleventh ovate, as wide as long, sides straight, briefly truncate at apex.

Pronotum about a third wider than long, base a little wider than apex, widest at middle; apex truncato-emarginate in moderate circular arc, angles obtuse; sides evenly, broadly and moderately arcuate in anterior two-thirds, thence convergent and oblique toward base, feebly and broadly sinuate before the small obtuse angles, lateral margin very narrow, bead fine and feebly reflexed, obsolete in basal fifth; base transverse, feebly and finely beaded, slightly wider than apex; disk evenly and moderately convex, quite evenly punctate, punctures small, separated by a distance equal to one to three times their diameters, a little more impressed, somewhat crowded and feebly muricate laterally.

Propleurae very sparsely punctate, punctures small, finely muricate, surface more or less rugulose.

Elytra not quite twice as long as wide, a little less than twice as long as the pronotum and about a fifth wider than the latter; humeri rounded, sides broadly and moderately arcuate, obliquely convergent in apical third to the obtusely subogival apex;

disk noticeably depressed, moderately and evenly convex, becoming strongly arcuately declivous and inflexed laterally, apical declivity gradual; surface densely punctate, punctato-rugulose laterally, punctures strong, not coarse and finely muricate, in approximate series as viewed longitudinally, not muricate in the sutural area. Scutellum small. Epipleurae somewhat smooth, sparsely and feebly punctate.

Legs moderately slender, the posterior noticeably rather long, about three-fifths longer than the anterior; metatarsi two-thirds as long as their tibia.

Male. Narrower, more elongate, elytra more obliquely narrowed apically. Abdomen moderately convex, first three segments flattened in middle third, feebly and narrowly impressed on the median line on first two; first three segments very densely punctate, tuberculose in the central area of the first two, punctures more or less finely muricate; last two segments sparsely punctate, impunctate areas present. First two segments of the protarsi with tufts of golden pubescence on tips beneath, interrupting the plantar grooves; first segment of the mesotarsi with a similar and dense pubescence on apical margin and angles beneath but scarcely obliterating the plantar grooves.

Measurements.—(Type) Length 17 mm.; width 7 mm.

Holotype.—Male. Collected at Camp Potwisha, Sequoia National Park, Tulare County, California, by Roy S. Wagner of Fresno, California. [No. 3714, in the author's collection, Museum of the California Academy of Sciences.]

Two male specimens studied, a paratype in Mr. Wagner's collection.

In the type the left tibiae and tarsi of the anterior and middle legs are missing.

Scabriventris can readily be mistaken for *constricta* Lec., the form and elytral sculpturing is similar in both species. In *constricta* the sides of the pronotum is abruptly constricted, straight and parallel before the basal angles; in *scabriventris* the sides of the pronotum are as in *scabripennis* Lec., gradually narrowed to base to which it is most closely related, the abdomen is not tuberculose in *constricta*.

Eleodes kaweana new species

Form oblong-ovate, moderately narrowed anteriorly, a little more than twice as long as wide. Color dull black. Head relatively small, as long as wide, anterior canthi feebly arcuate and as prominent as the eyes; sides arcuate and rather rapidly convergent to the epistomal apex, feebly notched at the oblique sutures; epistoma truncate at apex, very slightly sinuate at middle, angles narrowly rounded; labrum transverse, broadly and arcuately emarginate at middle of apex, angles evenly rounded; frons slightly convex, more or less feebly and irregularly impressed, evenly punctate, punctures small, separated by a distance equal to one to three times their diameter, frontal suture absent. Eyes short, transversely subreniform, continuing the curvature of the tempora, not in the least prominent. Antennae long and slender, extending a little beyond the pronotal base, distal three segments not incrassate; third segment as long as the fourth and fifth together, fourth slightly longer than the fifth and about twice as long as the second, fifth to the eighth inclusive equal in length, ninth and tenth rounded, as long as wide, not wider than the preceding segments, eleventh slightly longer than wide, ovate and oblique at apex.

Pronotum almost subcordate, widest slightly before the middle, apex feebly and arcuately emarginate in moderate circular arc, angles obtuse, not prominent; sides broadly, evenly arcuate in anterior two-thirds, thence straight, convergent to base, not sinuate before the obtuse angles; base slightly arcuate and equal to the apex, marginal beads fine; disk evenly and moderately, finely punctate, punctures discrete laterally where they become slightly granulate, separated by a distance equal to two to four times their diameter. Propleurae very sparsely muricato-granulate.

Elytra oval, about two-fifths longer than wide, humeri broadly rounded and continuous with the evenly and moderately arcuate sides that converge in apical fourth to apex, the latter rather narrowly rounded; disk moderately depressed, not strongly convex, becoming strongly and arcuately declivous and inflexed laterally, apical declivity arcuate and more or less oblique; discretely punctate, punctures finely muricate in the central area, becoming somewhat granulato-muricate laterally and apically, and appear in approximate series when viewed longitudinally, interstitial surface not rugose nor tuberculose; the punctures separated throughout by a distance equal to three to six times their diameter.

Under surface of body finely punctate, quite densely so on first three segments of the abdomen. Legs rather long and slender; metatarsi about three-fifths as long as their metatibia.

Male. More elongate, elytra a little less than three times as long as the pronotum and a third wider. Abdomen quite horizontal with the sterna, less than moderately convex, broadly but not strongly impressed in middle third of first three segments; second segment twice as long as the fourth, fifth as long as the third, as well as the postcoxal part of the first and a little shorter than second. First segment of the protarsi with a small tuft of golden pubescence at tip beneath interrupting the plantar groove, the latter distinct on the other segments; first segment of the mesotarsi with simply an apical fringe of yellow spinules beneath, grooves open.

Female. More robust, elytra more broadly oval, slightly inflated. Abdomen horizontal, more convex and not impressed; segments as in the male. Tarsi without pubescent tufts.

Measurements.—(Types) Length 18 to 18 mm.; width 7.5 to 8.5 mm.

Holotype.—Female. Collected by Roy S. Wagner of Fresno, California, June 28, 1931, at Kaweah, Tulare County, California. [No. 3715, and *allotype*, male, No. 3716, in the author's collection, Museum California academy of Sciences.]

Nine specimens studied, six designated as paratypes in Mr. Wagner's and my own collection. Mr. Wagner has permitted one paratype to be deposited in the Museum of Comparative Zoology, Cambridge, Mass.

Kaweana is a very distinct species and unique in the character of the elytral sculpturing, the small muricate punctures being discrete throughout without intermixture of rugosity or tubercles; the sides of the pronotum are gradually convergent behind the middle to the base as in *scabripennis* Lec., in which species the elytra are densely muricato-rugose as in *consobrina* Lec. In the latter species the pronotum is more or less transverse, sides strongly arcuate and distinctly sinuate and parallel before the basal angles. *Kaweana* should follow *scabripennis* in our lists.

Male genital characters.—An examination of the edeagi shows the apicale of the edeagophore to be triangular, broad at base and rather suddenly arcuately sinuate at the sides in basal fourth, thence gradually convergent to apex which is unusually slender; the dorsal surface is rather strongly convex and a feeble median groove is indicated; the basale is oblong, broader than usual and well depressed.

Female genital characters.—The genital segment is triangular as usual. Dorsal plate of each valve oblong and evenly arcuate at apex, very narrowly explanate laterally with the submarginal groove rather feeble; apex semi-membranous and prominent, finely setose; fossae somewhat dorso-lateral and the appendages very short mammilliform with three or four long setae at tip.

A specimen was submitted to Mr. Nathan Banks, of the Museum of Comparative Zoology at Cambridge, for comparison with LeConte's type of *Eleodes* (*Blapylis*) *scabripennis*. Mr. Banks responded as follows: "The type of *Eleodes scabripennis* Lec. has the elytral sculpturing as in *consobrina* Lec., in fact extremely close to the specimen of *consobrina* that you have sent. The type of *consobrina* may be a worn specimen as the ridges are less sharp and the pronotum seems to be a little broader than in your *consobrina*. The pronotum of *scabripennis* is not near as broad, nor so much narrowed behind as in *consobrina* and your *kaweana*. Certainly *kaweana* is very different from *scabripennis* both in elytral sculpture and in the shape of the pronotum, broader in proportion to length and more narrowed behind." It is to be remembered that the pronotum in *consobrina* varies in relative width, always wider in the female than in the male; in a series of specimens the elytral sculpturing will vary as remarked above concerning the LeConte type and the specimen which I sent for comparison.

The middle lobe of the mentum is relatively small, triangular, subacute at apex; surface bi-impressed and convex on the median line.

Eleodes oblonga new species

Form oblong-oval, about two and a half times as long as wide. Color piceous to black; luster subopaque and alutaceous.

Head slightly transverse, tempora and eyes together evenly convex, sides over the antennal insertions rather strongly arcuate, thence convergent, almost straight to the rounded epistomal angles, broadly and feebly emarginate at the oblique sutures; epistomal apex broadly and slightly emarginate; frons and epistoma evenly and slightly convex, supra-antennal convexities moderately convex, surface slightly impressed within and against the anterior border of the eyes, oblique sutures fine and feeble, frontal obsolete, replaced by an impunctate area, punctures small and sparse centrally, separated by a distance equal to two to six times their diameter, denser and coarser at the periphery, each with a small black seta. Labrum transverse, apical margin arcuate with a shallow sinus at middle. Middle lobe of mentum moderately small, sides convergent from middle to apex, the latter rounded; surface very slightly impressed laterally, feebly punctato-asperate; lateral lobes small and well reflexed. Antennae slender, not incrassate, as long as the pronotal width, extending slightly beyond pronotal base; second segment small, as long as wide, third elongate, subcylindrical, two and a half times as long as the second and quite equal to the combined length of the fourth and fifth; segments two to seven inclusive equal in width, fourth about a third longer than wide, a little longer than the fifth, the latter about a fourth longer than wide and a little longer than sixth; sixth and seventh as long as wide, eighth quadrato-triangular and as long as wide, a little wider than seventh; ninth and tenth subspherical, ninth about a fourth wider than the eighth or tenth, eleventh a little narrower than the tenth and about a fourth longer than wide, sides convergent apically, apex more rounded than oblique.

Pronotum two-fifths wider than long; apex a fifth wider than the head, truncato-emarginate in feeble circular arc, marginal bead rather coarse, obliquely declivous and with a line of punctures, angles rather broadly rounded, not at all prominent; sides broadly, evenly and rather strongly arcuate, convergent posteriorly, scarcely sinuate before the small and slightly prominent basal angles which are formed by the coarse basal bead, lateral beads fine and rather thin; base broadly arcuate, a little wider than apex; disk evenly convex, punctures small, each more or less within a round and extremely shallow impression which are more or less contiguous, the peripheral punctures become more crowded, each with a small shining granule, impressions less evident, appearance somewhat eroded, setae very short.

Elytra oblong-oval, one-fifth wider than the pronotum and not quite two and a half times as long, one-half longer than wide; base wider than the pronotal base, not margined, humeri rounded; sides broadly, moderately arcuate and parallel in basal two-thirds, thence more arcuato-obliquely convergent to the rather narrowly rounded and subogival apex; disk moderately convex, sides moderately broadly and arcuately declivous, in apical fourth arcuately, obliquely and quite rapidly declivous, surface subasperately punctate, punctures small in the central area where the surface is more or less irregular from shallow impressions, laterally and apically the punctures become muricato-tuberculate, tubercles very small and shining, no distinct series, surface has a somewhat eroded appearance.

Abdomen moderately convex, feebly and broadly impressed in middle third on first two segments; surface more or less irregularly creased, somewhat densely punctate, punctures not coarse and finely muricate, smaller and sparser on last two segments. First segment on the median line equal in length to the second and third together, fifth twice as long as the fourth, second one-sixth longer than the third.

Legs moderate in length, tarsi elongate, somewhat slender, spinules of plantar surface tawny; first two segments of the protarsi with small rounded and rather prominent tuft of pubescence at tips beneath obstructing the plantar grooves; first segment of mesotarsi with a similar but smaller tuft. Metatarsi two-thirds as long as their tibiae; segments two and three of each subequal, together as long as the first, the latter as long as the fourth.

Measurements.—(Type) Length 15 mm.; width 7 mm.

Type.—Male. Bearing a "Cal." label without other data. [No. 3717, in the author's collection, Museum of the California Academy of Sciences.]

Five other specimens labeled *scabripennis* Lec. are in the Casey collection in the National Museum; two of the specimens have a "Yreka, Cal." label, the other three simply a "Cal." A paratype in my collection was given to me by Col. Casey in 1909, and it is perfectly homomorphic with the type and those in the Casey collection.

Oblonga is to be associated with *scabripennis* Lec. and should follow *scabriventris* in our lists. It differs from the related species by its oblong-oval form, peculiar and somewhat eroded sculpturing, the pronotal and elytral surfaces being feebly irregular from small rounded impressions in the central areas and, besides the extremely minute reticulations give it a distinct alutaceous luster. All of the specimens studied have the same somewhat immature color.

Neobaphion elongatum new species

Form elongate subfusiform, nearly three times as long as wide. Color black, trophi more or less rufous, fifth ventral segment of same color; luster subopaque to feebly shining and alutaceous.

Head relatively small, fully twice as wide as long before the post-ocular line, or equal from the nuchal constriction; sides convergent, supra-antennal convexities moderately strongly arcuate basad to the oblique sutures, not quite as prominent as the eyes, epistoma straight laterally, angles broadly rounded, apex arcuato-truncate; front feebly convex, broadly flattened in the central area, sutures obsolescent, punctures small, very widely separated and feebly defined, at periphery the punctures are coarser, stronger and separated by a distance equal to one or two times their diameters. Labrum transverse, sides arcuate, angles rounded, apex broadly and rather feebly emarginate in middle third, margins fimbriate and the indistinct punctures with moderately long and semirecumbent setiform hairs. Eyes slightly more prominent than the sides and continuing the curve of the tempora, facets moderately small. Antennae not incrassate, long and slender, extending to basal seventh of elytra, segments two to eighth inclusive obconical, second small and as long as wide, third very elongate, four times as long as second and equal to the combined length of third and fourth, the latter and seventh equal in length, sixth and eighth a little shorter and equal, ninth and tenth obconico-ovate and a little longer than wide, eleventh subfusiform and as long as eighth.

Pronotum two-sevenths wider than long, widest at or a little before the middle, not quite twice as wide as the head; apex moderately emarginate between the subacute and somewhat prominent angles; sides moderately strongly and evenly arcuate in anterior two-thirds, thence less so and convergent to the obtuse but distinct basal angles, marginal beads thin and reflexed; base slightly arcuato-truncate, equal to apex; disk less than moderately and evenly convex, narrowly impressed within the lateral beads, punctures small, not very distinct, rather widely separated, not denser laterally and slightly granulate in the impressed areas.

Elytra elongate, twice as long as wide, about three times the length of the pronotum, obliquely narrowed apically, apex subacute; base transverse, not wider than pronotal base, humeri rounded; sides broadly and less than moderately arcuate, straighter and convergent in apical third; disk depressed, scarcely convex, rapidly and quite narrowly, arcuately declivous and inflexed laterally, oblique and gradually declivous in apical fourth; surface asperate, finely and densely punctate, punctures finely muricate, becoming gradually feebly muricato-tuberculate laterally and apically. Scutellum very small.

Prosternal process subacute, mucronate with apex deflexed. Undersurface of body sparsely punctured, punctures more or less asperate. First abdominal segment on median line equal to combined lengths of third and fourth segments, behind the coxae a little longer than the third, second as long as fifth and twice as long as the fourth. Legs long and slender, femora gradually subclavate; profemora obtusely subdentate close to apex; each protibia briefly cylindrical at base, thence abruptly widened and parallel to apex; mesotibiae quite straight, very gradually widened to apex; metatibiae not quite as long as their femora, dilated and parallel in apical five-twelfths, arcuate and cylindrical in basal seven-twelfths. Tarsi elongate and slender, a metatarsus about two-thirds as long as its tibia. First segment of the metatarsi is as long as the fourth, second and third subequal and together equal to the first.

Measurements.—(Type) Length 20 mm.; width 7 mm.

Type.—Male. Collected at Yerrington, Nevada, July-August, 1908. [No. 3718, in the author's collection, Museum of the California Academy of Sciences.]

One paratype, male, taken at Constantia, Nevada, collected by Geo. Haley. This specimen is more opaque and densely alutaceous, elytra more strongly asperate laterally than the type, the femora are more slender and more noticeably curved in adaptation to the sides of the body, the mouth-parts are piceous and the fifth abdominal segment much less rufous; length 18 mm., width 6.5 mm., otherwise as in the type.

A very distinct species and quickly separated from *planipennis* Lec., by the elongate form of the male, long antennae and legs; the metafemora being arcuate in basal two-thirds, dilated and parallel apically. *Planipennis* is more or less shining and the male is never as narrow and elongate as in *elongatum*. The two specimens have been in the author's collection upwards of twenty-five years, waiting for some collector to discover the female, which is at present unknown.

Amphidora parallela Casey, Mem. Coleop., xi, p. 328, 1924.

Type, female of *Stenotrichus rufipes* Lec. I have examined the type in the Casey collection at the National Museum, Washington, D. C. Males are usually much smaller than the females. The disparity in size is often remarkable. The following is an example: Many years ago I collected near San Diego, California, a pair in copula. These have the following measurements which have been made directly from the specimens in my collection: Male, length 6 mm.; width 2 mm. Female, length 11 mm.; width 4 mm. *Parallela* is a synonym of *rufipes* and not an *Amphidora* Esch.

Stenotrichus confluens Casey, Mem. Coleop., xi, p. 329, 1924.

The type is a small, poorly developed male of *Stenotrichus rufipes* Lec. The integuments are minutely wrinkled and shows evidence of poor nutrition and unfavorable environment. *Confluens* Casey is a synonym of *rufipes* Lec.

Eutriorophus tuckeri Casey, Mem. Coleop., xi, 297, 1924.

This is a true *Stibia* Horn. The type was collected at Tucson, Arizona. Two specimens are before me, both from the type region, one in the collection of Roy S. Wagner of Fresno, California, the other in my own. *Eutriorophus* is a synonym of *Stibia* and the name should be *Stibia tuckeri* (Casey).

A MONOGRAPHIC REVISION OF THE SPECIES OF CENTRONOPUS SOLIER INHABITING AMERICA NORTH OF MEXICO

(COLEOPTERA: TENEBRIONIDAE)

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(Plates X and XI)

In the following review two new species will be described, as well as notes on the species known to inhabit Mexico. In 1859, LeConte created the genus *Scotobaenus* to receive a species which he described as *parallelus*. LeConte's generic term was suppressed as a synonym of *Centronopus*, founded by Solier in 1848. Three species have been described from Mexico and with those of the United States raises the number of species to six.

My technique in the present study has been the same as that given in my Monograph of the Eulabes.[1] The facts presented are based on a considerable series in my own collection, supplemented by those in the collections of Dr. Edwin C. Van Dyke, The Museum of the California Academy of Sciences, The Academy of Natural Sciences of Philadelphia, Chas. Liebeck of Philadelphia and Roy S. Wagner of Fresno, California. Comparison has been made with the LeConte type of *parallelus* in the collection of the Museum of Zoology of Harvard University at Cambridge, Massachusetts, by Mr. Nathan Banks.

As usual in my studies the recorded facts are based on dissections and carefully made camera lucida drawings. The study of the genital structures has proved as significant as previously reported for the Eleodiini and Eulabes. The studies of Sharp and Muir* have clarified our knowledge of the general anatomy of the third lobe and which I accept; variations of far reaching importance are to be found in the different taxonomic grades.

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[1] Trans. Amer. Ent. Soc., LVIII, pp. 36–100, pl. 1–6, (1932).

* Trans. Ent. Soc. London, 1912, p. 477–642.

Dried laboratory material is not useful for determinate studies, but sufficient for generic and specific definitions; fresh specimens are necessary for phylogenetic and anatomical investigations. Their dissection requires high technical skill.

CENTRONOPUS Solier

1848. *Centronopus* Solier, Studi Ent., I, p. 154 and 258. (Essai Collapterides, p. 8 and 112.)

1859. *Centronopus* Lacordaire, Gen. Col., v, p. 360. (nec Horn).

1859. *Scotobaenus* LeConte, Proc. Acad. Nat. Sci. Phila., 1859, p. 87.

1870. *Scotobaenus* Horn, Proc. Amer. Philos. Soc., XIV, p. 340. (Revis. Tenebr.)

1885. *Centronopus* Champion, Biol. Centr.-Amer., IV, pt. 1, p. 99. *Centronipus* Dejean in litt.

Form elongate oblong, moderately depressed, elytra not connate, wings rudimentary (Pl. XI, fig. 15). Head somewhat transverse, front hemihexagonal, epistoma plane, frontal suture rather strongly impressed; labrum broadly rounded at apex (Pl. X, fig. 17). Mentum distinctly trilobed; middle lobe small, subhexagonal, free and prominent anteriorly, apex more or less sinuato-truncate, surface convex along the middle, strongly foveate within the lateral margins, coarsely punctate; lateral lobes small and inflexed, angles acute. Antennae (Pl. X, fig. 8) moderate in length, slightly thickened apically, second segment short, third twice as long as the latter, distal four segments rounded. Gular peduncle moderate. Epipleurae terminating opposite base of fifth abdominal segment. Legs moderate, more or less dissimilar in the sexes; femora (Pl. X, figs. 1, 2, 3 and 4) more or less clavate and compressed, in the male the inferior surfaces of the middle and posterior feebly or not margined, densely or more or less sparsely pubescent in about basal one-half; in the female the ventral surface of the femora are glabrous and not pubescent. Tibiae slender, each slightly curved at apex, apical external angle evenly rounded and there is a dense tuft of short pubescence on the inner face of the apex partly obscuring the spurs (Pl. X, figs. 9 and 10); ventral surface of the middle tibiae of the male feebly and imperfectly grooved; the anterior distinctly grooved with margins more or less prominent, the external irregularly tuberculate. Tibiae of the female not grooved. First four segments of the tarsi clothed beneath with dense yellow pubescence; metatarsi two-thirds as long as their tibia, first segment as long as the fourth. Tibial spurs (Pl. X, figs. 9 and 10) short, robust, about a half longer than wide and equal.

Generic Genital Characters

Male. Edeagophore[2] (Pl. XI, figs. 1 to 9) elongate flax-seed-shaped, about four and a half times as long as wide, comparatively feebly arcuate, glabrous, well chitinized and castaneo-piceous in color. Apicale elongately triangular, a little more than twice as long as wide at base, dorsally a distinct median groove is present in about apical third, apex feebly emarginate or very slightly cleft; a fusiform group of spinules on the lateral margin from the mid-point to apical fourth, which are directed basad and laterad; inflexed sides of the dorsal plate continuous with the ventral without suture, the alae (Pl. XI, fig. 8H, and fig. 9I) extending basad between the inflexed sides of the basale (valvifer) to about basal third. Genital fissure elongately fusiform, of moderate width, exposing the apex of the middle lobe (Sharp and Muir) within the genital fossa (Pl. XI, figs. 7F and 8G). The middle lobe is strongly chitinized apically, hamate and decurved at apex and with a post-apical uncus directed ventro-basad. Basale (Pl. XI, fig. 4C) oblong, more or less depressed semi-cylindrical, moderately convex, three times as long as wide, comparatively feebly arcuate basally.

Female. Genital segment (aedeaga[3]) (Pl. XI, figs. 10 to 14) elongate, strongly chitinized, a little more than twice as long as wide, subconical, somewhat compressed apically, directed upward at an angle of about 30 degrees to the longitudinal axis of the basale (valvifer of Tanner). Valves in full adduction when in a state of physiological rest, completely enclosing the pudendal membranes; dorsal plates arcuately in continuity with the latero-ventral plates without suture or line of demarcation. Ventral plates formed by three sclerites each, the apical with a slightly oval stylifer which occupies the entire apex of each valve from the dorsal to the ventral suture. Appendages (styli) short, as long as wide, cylindrical and supporting at apex a pencil of about six long setae which are equal in length to the distance between the fossae with the valves at rest; fossae round, shallow and large. Middle sclerites very short and transverse, more or less at a tangential angle between the apical and basal sclerite, not or only partly visible when viewed from the side. Basal sclerite oblong, about twice as long as wide. Basale very elongate, bilateral, separated by a narrow membranous interval ventrally, obscured by the anal canal dorsally and connate laterally with the paraprocts (Tanner[4] speaks of the latter as a part of the ninth tergite which has been shifted around, in the present case in juxtaposition with the valvifer of the ventral region), chitinized and glabrous; the stiffening rods or baculi are recognized as black lines in the chitinous lateral walls.

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[2] A Monograph of the Eleodiini. *Bull. 63, U. S. Nat. Mus.*, p. 20, (1909).

[3] See Comments, p. 222.

Characters Common to the Species North of Mexico

Color black, mouth-parts piceous, integuments more or less shining to subopaque. Head and prothorax finely and moderately densely punctate. Head (Pl. X, fig. 17) moderate, about a fifth narrower than the pronotal apex. Pronotum (Pl. X, fig. 18) wider than long, a little narrowed posteriorly, sides broadly arcuate, broadly but not deeply sinuate before the basal angles; base and apex emarginate, apical angles rounded, the basal acute and moderately prominent. Elytra usually not wider than the pronotum, base transverse, humeri small, obtuse and more or less slightly prominent anteriorly; surface sculptured with rows of punctures in short impressed lines; interstitial surface moderately densely punctate, punctures small, more or less transversely creased between the rows of punctures, the creases starting mainly from the punctures. Femora glabrous, finely and very sparsely punctate; tibiae densely and coarsely punctate.

GENOTYPE: *Centronopus extensicollis* Solier as *Tenebrio suppressus* Say, 1835, a Mexican species.

Up to the present time the only species known to occur north of Mexico has been *parallelus* LeConte. It was collected in the Sacramento Valley of California by Mr. S. S. Rathvon. LeConte has stated in connection with his definition of the generic term *Scotobaenus* that it is most closely allied to *Upis*, *Centronipus* and *Nyctibates*. Without any doubt *Centronopus* is most closely related to *Scotobates* Horn as the genital characters are of the same peculiar type. Horn reviewed the genus and species in his Revision of the Tenebrionidae of America, North of Mexico. Neither LeConte or Horn, as well as Champion in the Biologia Centrali-Americana have referred to the pubescence of the ventral surfaces of the femora and tibiae.

In order to properly observe the pubescence it is absolutely essential that the insect be free from all oily exudate. It is necessary to subject the specimens to a chloroform bath to restore the golden color of the pubescence. Discolored specimens is probably the reason why those characters have not been observed and mentioned before.

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[4] Trans. Amer. Ent. Soc., LIII, p. 19, (1927).

Mr. Roy S. Wagner of Fresno, California, very recently called my attention to marked differences in the form of the metafemora of certain specimens, as well as in the distribution and character of the pubescence of the femora. As a result of the keen observations of Mr. Wagner, two new species will be described below. The taxonomic, generic and specific values of structural characters are not invalidated because they happen to be confined to certain parts or appendages, while the body for the greater part remains homomorphic in the species. Structural characters are of generic significance, while their modification by sculpturing, size, color and pubescence give specific values. It happens that in *Centronopus* Solier the specific characters are found in the legs and to some extent in the primary genital characters. The species may now be defined as follows:

Centronopus parallelus (LeConte)

1859. *Scotobaenus parallelus* LeConte, Proc. Acad. Nat. Sci. Phila., Feb., p. 88.
1870. *Scotobaenus parallelus* Horn, Proc. Amer. Philos. Soc., xiv, p. 340, pl. 5, fig. 9. (Revis. Tenebr.)
1873. *Scotobaenus parallelus* Crotch, Check-List Col. Amer. North Mex., p. 105.
1885. *Centronopus parallelus* Henshaw, List Col. Amer. North Mex., p. 119.
1920. *Centronopus parallelus* Leng, Cata. Col. Amer. North Mex., p. 235.

In both sexes the metafemora are strongly clavate (Pl. X, fig. 2), inflated in apical one-half, thence rapidly narrowed and subcylindrical to base. In the male the middle third of the ventral surface of each metafemora (Pl. X, fig. 13) is evenly and extremely densely clothed with short, very fine and soft yellow pile. The mesofemora are similarly pubescent but to a less degree. Ventral surface of each metatibia (Pl. X, fig. 10) is clothed with coarser, short pubescence in apical three-fifths; in about middle third the hairs become considerably longer forming an elongate tuft which somewhat intrudes upon the inner surface of the tibiae, (Pl. X, fig. 7) to become distinctly visible as such when viewed obliquely from behind and within when the legs are pulled away from against the body. Ventral surfaces of the profemora not pubescent: those of the protibiae grooved, external margin of the groove most prominent near base and apically, the intervening sinuation rather strong and irregularly tuberculate (Pl. X, fig. 5), inner margin not prominent and with very small tubercles. Mesotibiae not or very feebly and imperfectly grooved ventrally and with four or five tubercles (Pl. X, fig. 6). In the female the femora are not pubescent; ventral surfaces of the tibiae are not grooved, punctures with short setae; the protibiae are straight and gradually widened from base to apex (Pl. X, fig. 11).

Measurements: Length 18.5 mm.; width 7.0 mm.

Genital Characters.—Male. Edeagophore (Pl. XI, figs. 3, 5 and 9) moderately stout, little more than four times as long as wide. Apicale sparsely and more or less subobsoletely punctulate; sides slightly arcuate and convergent to apical fourth, thence briefly sinuate and parallel to the feebly emarginate and obtuse apex, slightly prominent at the spiculate area, spicules subdentiform; base subtriangularly lobed, broadly and feebly sinuate laterally; dorsal surface rather strongly convex, dorsal groove in apical half may be more or less interrupted, an elongate oval and shallow median impression may be present, laterally rather broadly and arcuately declivous, continuous with the ventral plates without suture—viewed from the side under oblique illumination there appears to be optical lines of demarcation passing from the apex of the basale to the spiculate area and apical margin of the genital fissure, indicating the line of greater convexity scarcely defined from the evenly convex ventral surface. The ventral plates and alae are not more prominent basad to the genital fissure, the latter rather widely fusiform, exposing the apex of the middle lobe within the genital fossa, the uncus is rather long and subacute. Margins of the alae contiguous for a distance nearly equal to the length of the fissure, thence separated by a narrow and deep membranous cleft between the middle third of the inflexed sides of the basale, beyond which they become connate, slightly convex and without a suture (Pl. XI, fig. 9I), ending in the membrane at basal fourth of the interval. A short and quite distinct chito-membranous paralar cleft (Pl. XI, fig. 9J) is present each side at apex of the inflexed sides of the basale, between the alae and inflexed side of the apicale near base. Basale three times as long as wide, less depressed, dorsal surface moderately strongly convex and somewhat broadly and arcuately continuous with the convex inflexed sides, ventral margins broadly arcuate and parallel; apex adapted to the base of the apicale and slightly emarginate laterally (Pl. XI, fig. 3) at an optical longitudinal line of demarcation.

Female. Genital segment (aedeaga) (Pl. XI, figs. 10, 11 and 13) finely, sparsely and distinctly punctate. Dorsal plates (Pl. XI, fig. 11P) angulate laterally at middle, surface lines straight longitudinally. The angulate sides divide the segment into a conical apical and a basal subquadrate part. Apical part: sides convergent and broadly, feebly sinuate to the moderately narrow and evenly rounded apex—viewed in full adduction. Dorsal plates broadly and arcuately continuous with the ventral from the dorsal to the ventral suture without a line of demarcation; base of each oblique from without inward and basad, conjointly angulate at the suture beneath the anal canal. Punctures of the stylifers setigerous, setae short, fine and erect. Basal part: sides straight and parallel. Ventrally the base of each apical sclerite is oblique from the angulation inward and basad to the ventral suture, and there conjointly sharply angulate at the medial ends of the middle sclerites; the latter about one-fifth as long as the basal sclerites, their apical and basal margins slightly arcuate, the sutures correspondingly sinuate. The apical sutures end at the angulation, from which point a short raised line or carinule extends briefly apicad. Basal sclerites oblique at apex and sinuato-arcuate at base, adapted to the middle sclerite and basale respectively, feebly punctulate laterally; arcuately continuous with the dorsal plates without lateral demarcation.

Basale (valvifer of Tanner) (Pl. XI, fig. 10 O) subcylindrical in transverse section, nearly three times as long as wide; sides parallel, divergent in about basal third, ventral margins separated by a membranous interval of varying width and which dilates in basal third between the arcuately divergent margins of the chitinous plates. Dorsal wall covered by the anal and rectal canal, connate laterally with the paraprocts (Pl. XI, fig. 11R). Dorsal wall of the anal and rectal sheath chito-membranous between the summits of the paraprocts which are separated above and permit of the distention and contraction of the rectal canal. Sutural margins of the dorsal plates, sclerites and basale slightly inflexed.

Location of type.—The LeConte type is in the collection of the Museum of Comparative Zoology, Harvard University, Cam-Cambridge, Massachusetts.

Distribution.—OREGON: Jackson County—Colestin, July 30, 1918, (E. P. Van Duzee). CALIFORNIA: Lassen County—(F. W. Nunenmacher). Siskiyou County—McCloud, October 15, 1918; Shasta City [formerly Sissons], July, (Blaisdell); Mt. Shasta, July 4, 1905, elev. 6000 ft., (Blaisdell); Shasta Retreat, July, elev. 2416 ft., (Blaisdell). Shasta County—Cayton, July 16, 1913, (E. P. Vanduzee). Eldorado County—Bijou, July 21, 1921, (Blaisdell); Fallen Leaf Lake, September 7, 1913, (J. R. Slevin). Placer County—Truckee, June 19, 1927; Cisco, Summit of the Sierra Nevada Mts., June, 1911, (L. Slevin). Plumas County—June 8, 1913, (F. W. Nunenmacher). Yuba County—Challange, July 15, 1928, (Roy S. Wagner). Calaveras County—Big Trees, July, and above toward Alpine County, elev. 5500 ft., July 13, 1907, (Blaisdell); Mokelumne Hill, March, elev. 1300 ft., (Blaisdell). Alpine County—Lombardi's Meadow [formerly Blood's Meadow], July, 1914, (Blaisdell).

Centronopus wagneri new species

Male. Metafemora less clavate (Pl. X, fig. 1), more gradually widened apically; ventral surface of each with an area of longer pubescence (Pl. X, fig. 14) on the median line, at about middle third of the length; the hairs are more or less erect and directed apicad and from each side toward the median plane; remaining surface more or less sparsely punctate and glabrous. Mesofemora with similar pubescence but smaller in area. Metatibiae with the ventral surface narrowly grooved, margins of which are clothed with short yellow pubescence, the inner densely so, tuft absent. Mesotibiae more or less obsoletely grooved on ventral surface with a line of short yellow hairs and about three to five small tubercles. Ventral surface of the protibiae grooved and smooth, external margin of the groove less prominent basally and apically, the intervening sinuation less evident and less strongly tuberculate.

Female. Ventral surface of the metatibiae and mesotibiae linearly margined, not grooved and sparsely setose, setae short. Protibiae not grooved, rather less widened apically; ventral surfaces setose, setae short.

Measurements: (Types) Length 20 to 21 mm.; width 7.5 to 7.8 mm.

Holotype.—Male, No. 3719, and *allotype*, female, No. 3720, in the author's collection, Museum of the California Academy of Sciences. Collected in General Grant National Park, North of Sequoia National Park on the Fresno-Tulare County line, June 10, 1923, by Roy S. Wagner of Fresno, California.

Paratypes in Mr. Wagner's collection and that of the Author. A pair have been also deposited in the collection of the Academy of Natural Sciences of Philadelphia.

The author takes great pleasure in dedicating the species to Mr. Wagner.

Distribution.—CALIFORNIA: Eldorado County—Fallen Leaf Lake, July, 1931, (O. H. Swezey). Madera County—Chiquito Creek, July 23, 1920, elev. 4100 ft. and Northfork, March 19, 1920, (Henry Dietrich). Fresno County—Huntington Lake, July 28, 1919, elev. 7000 ft., (Van Duzee and Blaisdell). Tulare County—Giant Forest, December 16, 1923, (Chas. Fox); General Grant National Park, June 10, 1928, (Roy S. Wagner).

Genital Characters.—Male. Edeagophore (Pl. XI, figs. 2, 4 and 7) somewhat slender, nearly six times as long as wide, moderately arcuate in basal third. Apicale (Pl. XI, fig. 4B) very sparsely punctulate on disk and laterally, twice as long as wide at base; sides feebly arcuate and convergent, slightly more prominent at the spiculate area, thence slightly sinuate, a little narrower and parallel in apical fifth to the very obtusely rounded, feebly cleft apex, spicules slender; dorsal surface moderately and evenly convex, a median and moderately impressed groove in apical half; base strongly and arcuately lobed in middle third, rather broadly sinuate laterally. Laterad the dorsal plate becomes more gradually, strongly and arcuately continuous with the lateroventral plate; viewed from the side under oblique illumination the lateral border appears somewhat more strongly convex and the ventral plate rather broadly and longitudinally impressed, so that it is more prominent at the fissure and distinctly angulate basad thereto. The genital fissure is fusiform and moderately narrow, within it can be seen the hamate and uncinate strongly chitinized apex of the middle lobe (Pl. XI, fig. 2D and 7F) projecting within the genital fossa. The median margins of the alae are contiguous basad to the fissure where they are most prominent ventrally, thence they are separated by an elongate, deep and narrow fissure opposite the apical half of the inflexed sides of the basale, basad to which the alae become connate without evidence of a suture, oblong in outline, ending at basal third of the basale where the interval becomes membranous. Basale (valvifer) oblong, about three and a half times as long as wide, moderately convex, depressed semi-cylindrical; sides parallel, the arcuately inflexed sides moderately wide with margins broadly arcuate, separated by the alae and membrane of the interval.

Female. General characters similar to *parallelus* Lec. Genital segment (aedeaga) (Pl. XI, fig. 14) more compressed, apex narrowly rounded vertically; punctures of the surface with fine short setae. Dorsal plate not angulate laterally but as in *punctatus* (see below), but more arcuately continuous with the ventral sclerites; sides feebly and very broadly arcuate and convergent to apex. Styli with a pencil of about five long slender setae. Ventral margins of the apical sclerites more rapidly and upwardly convergent to apex rendering it more narrowly rounded vertically. Middle sclerite short, subequal in width, parallel, visible laterally and on the same plane as the general surface. Stylifer more oval, fossa slightly oval and shallow.

Basale (valvifer) more definitely connate and less defined from the paraprocts (Pl. XI, fig. 14S), line of demarcation obliterated; dorsally the paraprocts are more prominent and inflexed, gradually and triangularly widened toward base to meet more or less on the median line to enclose the rectal canal, dorsal sheath of the latter chito-membranous.

Centronopus punctatus new species

Male. Metafemora gradually widened from base to apex (Pl. X, figs. 3 and 4), very feebly inflated apically; ventral surface in basal half not margined, rather coarsely and sparsely punctate, (Pl. X, fig. 15), peripheral punctures smaller, each with a short, appressed seta directed toward apex. Mesofemora similarly punctate but less so. Each metatibia loosely clothed with yellow pubescence on ventral surface, hairs at about middle are longer and denser, forming a short tuft which is less conspicuous than in *parallelus* Lec. when viewed from behind and within. Profemora moderately inflated, more or less arcuate, gradually narrowed in basal third. Ventral surface of the protibiae grooved, outer margin slightly more prominent near base and apically, the intervening sinuation moderate and sparsely, irregularly tuberculate; margins with short setae. Ventral surface of the mesotibiae with the groove feeble or obliterated, roughly sculptured, sparsely setose and with about three or four small tubercles along middle third.

Female. Femora without pubescence, ventral surfaces straight, not grooved, sparsely setose. Tibiae roughly sculptured and not grooved; protibiae gradually widened from base to apex as in *parallelus* Lec.

Measurements: (Types) Length 19 to 19 mm.; width 7.5 to 7.8 mm.

Holotype.—Male, No. 3721, and *allotype,* female, No. 3722, in the author's collection, Museum of the California Academy of Sciences. Collected at Huntington Lake, Fresno County, California, at an elevation of 7000 ft., on July 8 and 27, 1919.

Paratypes in the collections of the author and Roy S. Wagner of Fresno, California. A pair has been deposited in the collection of The Academy of Natural Sciences of Philadelphia, Pa.

Distribution.—CALIFORNIA: Mariposa County—Yosemite Valley, May 14, 1929, (L. Slevin); August 26, 1916; June 12, 1914, (F. W. Nunenmacher). Tuolumne County—Big Tree Grove, May 16, 1929. Fresno County—Huntington Lake, July 10, 1919, elevation 7000 ft., (E. P. Van Duzee).

Genital Characters.—Male. Edeagophore (Pl. XI, figs. 1, 6 and 8): Apicale sparsely punctulate dorsally and laterally, punctules varying in size; sides slightly arcuate and convergent to about apical fourth, thence parallel to the obtusely rounded and feebly emarginate apex. Spiculate areas extend from the mid-point to apical fourth, spicules somewhat dentiform; base strongly and arcuately lobed in middle third, thence slightly sinuato-arcuate laterally; dorsal surface less than moderately convex, gradually more strongly and arcuately continuous with the ventral plates, under oblique illumination a line of slightly greater convexity seems to mark the point of transition; discal groove linear, well impressed in less than apical half. Each lateral moiety of the apex separately convex. Latero-ventral plates moderately convex basad to the genital fissure, less so apically; the surface is linearly and longitudinally slightly subangulate from the middle of the apex of the basale ventrally to the lateral margin of the spiculate area. The alae are contiguous for a short distance basad to the fissure, thence separated by an elongate, narrow and deep fusiform depression, to again become contiguous at a distinct suture, becoming gradually attenuate with apices subacute, ending in the membranous interval at about basal third between the inflexed sides of the basale.

Basale oblong, three times as long as wide, sides feebly arcuate and parallel; surface moderately convex from side to side, sinuate at apex and adapted to base of the apicale; laterally the apex is feebly emarginate at a feebly subangulate line of demarcation between the dorsal and ventral surfaces, as observed under oblique illumination. Inflex sides rather wide, ventral margins broadly arcuate, separated by the chitinous alae and membrane in basal third.

Female. Similar to *parallelus* Lec., except: Genital segment (aedeaga) (Pl. XI, fig. 12) compressed as in *wagneri*. Punctures not visibly setigerous. Dorsal plate not angulate laterally at middle, evenly and arcuately continuous with the ventral sclerites. Sides broadly, not strongly arcuate and convergent at apex. Styli short mammilliform with a pencil of five or six long setae at apex. Stylifer oval as in *parallelus* Lec., floor convex, with a large oval impression in which the large, shallow fossa is located; punctures sparse bearing fine, short hair-like setae.

Synopsis of Differential Specific Characters

Ventral surface of metafemora and mesofemora pubescent in basal half.

Pubescence abundant, dense, very short and of the nature of soft pile; meso- and metafemora distinctly clavate; metatibiae each with a tuft of longer hairs as observed from within and behind .... *parallelus* LeConte

Pubescence of ventral surface longer, not abundant, arranged along median line longitudinally; femora not or very moderately clavate; metatibiae without tuft of longer hairs. *wagneri* new species

Ventral surface of the metafemora and mesofemora rather sparsely punctate in about basal half; punctures with short and inconspicuous setae; meso- and metafemora gradually widened toward apex; metatibiae with pubescent tufts. *punctatus* new species

Synoptical Statement of Male Specific Genital Characters.

Alae connate and oblong, without evidence of a suture, at termination between the inflexed sides of the basale.

Edeagophore somewhat robust; apicale rather strongly convex both dorsally and ventrally, disk with a shallow, broad impression on median line in middle third; spicules more dentiform; basal lobe subtriangular.....*parallelus* LeConte

Edeagophore more elongate; apicale less convex, ventral surface of each side longitudinally impressed, prominent at sides of genital fissure and angulate just basad thereto; spicules slender; basal lobe strongly arcuate.....*wagneri* new species

Alae not connate at termination, but attenuated and subacute at apex, contiguous at a suture. Apicale rather strongly convex both dorsally and ventrally, not prominent basad to the genital fissure; basal lobe strongly arcuate; spicules more dentiform; genital fissure rather large. Basale (valvifer) less slender, inflexed sides less convex.
punctatus new species

Synoptical Statement of Female Specific Genital Characters

Genital segment angulate at middle of the lateral margin of the dorsal plates; middle sclerites tangentially oblique to the surface plane and scarcely visible from the side.
parallelus LeConte

Genital segment more conical, not angulate at side of dorsal plates, but with the sides arcuate from base to apex and more compressed; middle sclerites very short and on same surface plane as the apical and basal. Basale (valvifer) more fully connate with the paraprocts.

Apex of the segment more broadly rounded dorso-ventrally, dorsal and ventral surface planes less convergent apically; stylifers feebly oval with surface flat..*punctatus* new species

Apex of the segment less broadly rounded dorso-ventrally, dorsal and ventral surface planes more convergent apically; stylifers distinctly oval with their surface convex and impressed at center, depression oval from which arises the stylus............................*wagneri* new species

COMMENTS AND DISCUSSION

In the present treatment of the species of *Centronopus* Solier, I have given as usual much care to the dissection and description of the primary genital characters. Facts are recorded as I have observed them, in a manner uninfluenced by the opinions of other writers. I am expressing below, my views concerning the use of the term aedeagus and an answer to certain criticisms.

Tά αιδοια signifies the private parts and is a general term. Sharp and Muir have acknowledged this fact. It is used in Anatomy in combination as aedoeology and aedoeogotomy. To give it a special limited meaning is arbitrary. Sharp and Muir consider the term aedeagus as applied to the male a " useful name for the combination of sclerites in the two adjacent layers of the male tube in the Coleoptera."[5] In my previous writings I have in part used the term in a general sense. From a grammatical standpoint it is a latinized Greek noun of the second declension, the plural being aedeagi. Sharp and Muir also acknowledge that a term must be found for the female structures. I propose that the term aedeaga be applied to the combination of sclerites in the female sexual segment. The primary sexual organs of the two sexes possess homologous parts, those that appertain to the particular function of each sex will be found vestigial in the opposite sex: In the male to fertilize and the essential mechanism to accomplish that purpose; in the female to be fertilized and to perpetuate the species by ovulation. I believe that the term aedeaga can be so applied and that it will be found as useful and valid as that used for the opposite sex. I have heard it remarked that the term would be liable to cause confusion. There should be no more confusion than in Latin and other romanic languages where the gender is indicated by the terminal letters us and a, or o and a.

In 1909,[6] I created the term adeagophore, for the male genital structures—a particular type of aedeagus—as exists in the Tenebrionidae. I am not prepared to state that it is applicable throughout the Tenebrionoidea. Its etymology is evident, being derived from αιδοια + φέρειν (to bear) and may be defined as a capsule or sheath bearing the middle lobe of Sharp and Muir, which contains within its depths the copulatory filament, duct or sac.

In my recent Monograph of the Eulabes,[7] I have tentatively applied the term aedeagus to the organs of both sexes without giving a gender termination, (which I have done in the present paper) and I began there also, the correlation of my terminology with that of other authors. Sharp and Muir in their Memoir on the Comparative Anatomy of the Male genital tube of the Coleoptera,[8] listed a few synonyms of the terms used by them. Their studies resulted in the recognition of eight Coleopterous Series.

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[5] Trans. Ent. Soc. of London, p. 484, (1912).

[6] Bull. 63, U. S. Nat. Mus., p. 20, (1909).

[7] Trans. Amer. Ent. Soc., LVIII, pp. 99–101, (Apr. 13, 1932.)

A discussion of the synonomy may prove helpful, bearing in mind that I am at present only concerned with the Tenebrionidae: Edeagophore (Blaisdell) is the tegmen of Sharp and Muir; it consists of two parts—the apicale (Blaisdell), lateral lobes of Sharp and Muir, inner lobes of Packard, united coxites of Tanner; basale (Blaisdell), basal piece of tegmen of Sharp and Muir, external lobes of Packard, valvifer of Tanner.

The middle lobe (Sharp and Muir) is the central part of the aedeagus, upon which the median orifice or external opening through which the enclosed copulatory filament or essential organ is evaginated; the lobe may be liguliform (Eleodes), tubular (Centronopus) or partially tubular so as to form a pallium (Blaps),[9] the latter ensheathing more or less the essential organ mentioned above. The homology of the clavae and pallium need special study. Concerning the middle lobe, I refer the reader to the Monograph of the Eleodiini[10] and Eulabes,[11] for I have illustrated and discussed it in those papers. In the figures given by Sharp and Muir of the edeagophore of *Eleodes dentipes* Esch.[12] are apparently diagrammatic for they do not agree in detail with my figures,[13] for the clavae are too curved and robust. In those figures the clavae or lateral processes of the middle lobe are lettered " ma," but no reference is given to them in the "Explanation of double letters" used. It is very unfortunate that the authors did not express their views regarding them, especially from the standpoint of homology. The clavae are present in all species of the Eleodiini and recent dissections show them present in *Cratidus osculans* Lec. of the subfamily Adeliinae.

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[8] Trans. Ent. Soc. of London, p. 477, (1912).

[9] Bull. 63, U. S. Nat. Mus., p. 503, pl. 9, fig. 4, (1909).

[10] Bull. 63, U. S. Nat. Mus., p. 21, pl. 9, figs. 11 and 12, (1909).

[11] Trans. Amer. Ent. Soc., LVIII, pl. 4, figs. 8 and 15, (1932).

[12] Trans. Ent. Soc. of London, pl. 68, figs. 163 and 163a, (1912).

[13] Bull. 63, U. S. Nat. Mus., pl. 9, figs. 6, 11 and 12, (1909).

Sharp and Muir have wrongly interpreted the term fornix edeagi,[14] confusing it with the "opening or area on the median lobe through which the internal sac or duct is evaginated." It has nothing whatsoever to do with the apical opening. I have defined it as follows: "Opposite the attachment of the clavae ventrally the surface membrane is reflected upon the internal wall of the apicale, forming the fornix edeagi." It is the line or angle of reflection of the membrane lining the genital fossa to the surface of the middle lobe at its base. As an illustration to make the fact clear (perhaps), it is analogous to the fornix valvulae which I have defined as the angle of reflection between the lateral pudendal membrane and the valvular membrane in the female genital segment (See page 23 of the Monograph).

ADDENDUM

List and Salient Characters of the Species of Centronopus Known to Inhabit Mexico

Centronopus suppressus (Say)

1835. *Tenebrio suppressus* Say, Boston Jour. Nat. Hist., I, p. 187.
1848. *Centronopus extensicollis* Solier, Studi Ent., I, p. 260 pl. 11, figs. 4–8. (Essai Collapterides, p. 114.) Chev. Dej. Cat., p. 226.
1859. *Centronopus suppressus* LeConte, Compl. Writ. Thomas Say, II, p. 659.
1875. *Centronopus suppressus* Horn, Trans. Amer. Ent. Soc., V, p. 151. [Mexico.]
1885. *Centronopus extensicollis* Champion, Biol. Centr.-Amer. Col., IV, pt. 1, p. 100, pl. 5, fig. 9 ♂.

Black. Head densely but minutely punctate, clypeus a little reflexed. Pronotum densely and minutely punctate, rather large; a large, slightly impressed spot on posterior margin; basal angles acute, margin with an impressed line. Elytra with impressed, punctate and crenate striae, interstitial spaces convex, impunctate, lateral edge acute. Protibiae with a strong tooth. Length ½ inch.

Habitat.—MEXICO: San Antonio de Arriba, Orizaba, Las Vigas and Cordova.

Plentiful according to Hoge.

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[14] Trans. Ent. Soc. of London, p. 482, (1912).

Centronopus grandicollis Champion

1885. *Centronopus grandicollis* Champion, Sturm in litt., Biol. Centr.-Amer., Coleop., IV, pt. 1, p. 100, (July).

Black, slightly shining. Head finely and very closely punctured in the male, anterior margin rounded and reflexed; in female epistoma truncate and anterior margin scarcely reflexed. Basal angles of the pronotum very prominent and subacute, base broadly emarginate within; disk broadly but feebly impressed before the base. Elytra long, depressed; sides abruptly narrowed just before the base. Length, male and female: 14.5 to 16 mm.

Habitat.—MEXICO: Jalapa, Hacienda de San Miguelito.

Centronopus bimaculatus Champion

1892. *Centronopus bimaculatus* Champion, Biol. Centr.-Amer., Coleop., IV, pt. 1, p. 521, (Nov.)

Elytra each with a large, transverse, reddish-yellow patch a little below the base, extending to the lateral margin but not to the suture. The male has all the tibiae triangularly toothed within. Head very broadly and deeply excavated between the eyes. Length, male and female: 11⅓ to 13 mm., breadth 4.5 to 4.75 mm.

Habitat.—MEXICO: Paso de San Juan in Vera Cruz, (Hoge), Actopan, (vide Flohr), Temax in North Yucatan, (Gaumer).

EXPLANATION OF PLATES

PLATE X

Fig. 1.—Right metafemur of *Centronopus wagneri* new species, male. Note that the femur is gradually narrowed from middle to base.

Fig. 2.—Left metafemur of *Centronopus parallelus* Lec., male. Note that the femur is distinctly and more rapidly narrowed from middle to base, as well as more inflated apically (in both sexes).

Fig. 3.—Left metafemur of *Centronopus punctatus* new species, male. Note that the femur is very gradually narrowed from middle to base.

Fig. 4.—Right metafemur of *Centronopus punctatus* new species, female. Femora similar in the sexes.

Fig. 5.—Right protibia of *Centronopus parallelus* Lec., male. Ventral surface grooved and smooth, edges prominent and irregularly tuberculate.

Fig. 6.—Left mesotibia of *Centronopus parallelus* Lec., male, showing less irregular margins.

Fig. 7.—Right metatibia of *Centronopus parallelus* Lec., male, showing pubescent tuft as viewed from behind and within.

Fig. 8.—Antenna of *Centronopus* Sol.

Fig. 9.—Right metatibia of *Centronopus punctatus* new species, male, showing pubescent area and short tuft. The latter not developed in *wagneri*, new species.

Fig. 10.—Left metatibia of *Centronopus parallelus* Lec., male, showing elongate pubescent tuft.

Fig. 11.—Left protibia of *Centronopus* Sol., female.

Fig. 12.—Elytral sculpturing in *Centronopus* Sol.

Fig. 13.—Ventral surface of right metafemur of *Centronopus parallelus* Lec., male. Note the extent of the pubescent area, which is of short, soft and dense pile.

Fig. 14.—Ventral surface of left metafemur of *Centronopus wagneri* new species, male. Note the smaller pubescent area, composed of longer hairs which are directed apicad and toward the mediam plane of the femur, situated in the middle third or two-fourths of the surface in middle third of length.

Fig. 15.—Ventral surface of right metafemur of *Centronopus punctatus* new species, male. Note the sparse punctures, each with a short seta appressed to surface and directed apicad.

Fig. 16.—Ventral surface of left metafemur of *Centronopus* Sol., female. Note that it is not pubescent, but only finely punctulate basad.

Fig. 17.—Head of *Centronopus* Sol., male.

Fig. 18.—Pronotum of *Centronopus* Sol., male.

PLATE XI

Fig. 1.—Lateral view of edeagophore (tegmen of Sharp and Muir) of *Centronopus punctatus* new species; E, ejaculatory duct.

Fig. 2.—Lateral view of edeagophore of *Centronopus wagneri* new species; D, median lobe of Sharp and Muir.

Fig. 3.—Lateral view of edeagophore of *Centronopus parallelus* Lec.

Fig. 4.—Dorsal view of edeagophore of *Centronopus wagneri* new species; A, tegmen of Sharp and Muir; B, apicale (apical piece of tegmen—Sharp and Muir); C, basale (basal piece of tegmen—Sharp and Muir).

Fig. 5.—Dorsal view of edeagophore of *Centronopus parallelus* Lec.

Fig. 6.—Dorsal view of edeagophore of *Centronopus punctatus* new species.

Fig. 7.—Ventral view of edeagophore of *Centronopus wagneri* new species; F, narrower fusiform genital fissure.

Fig. 8.—Ventral view of edeagophore *Centronopus punctatus* new species; G, wider fissure and genital fossa; H, attenuated alae united by a suture and acute at apex.

Fig. 9.—Ventral view of edeagophore of *Centronopus parallelus*. Lec.; I, alae connate and oblong at apex without suture; J, paralar cleft.

Fig. 10.—Ventral view of genital segment of *Centronopus parallelus* Lec. female; K, stylifer; L, apical sclerite; M, middle sclerite; N, basal sclerite; O, basale.

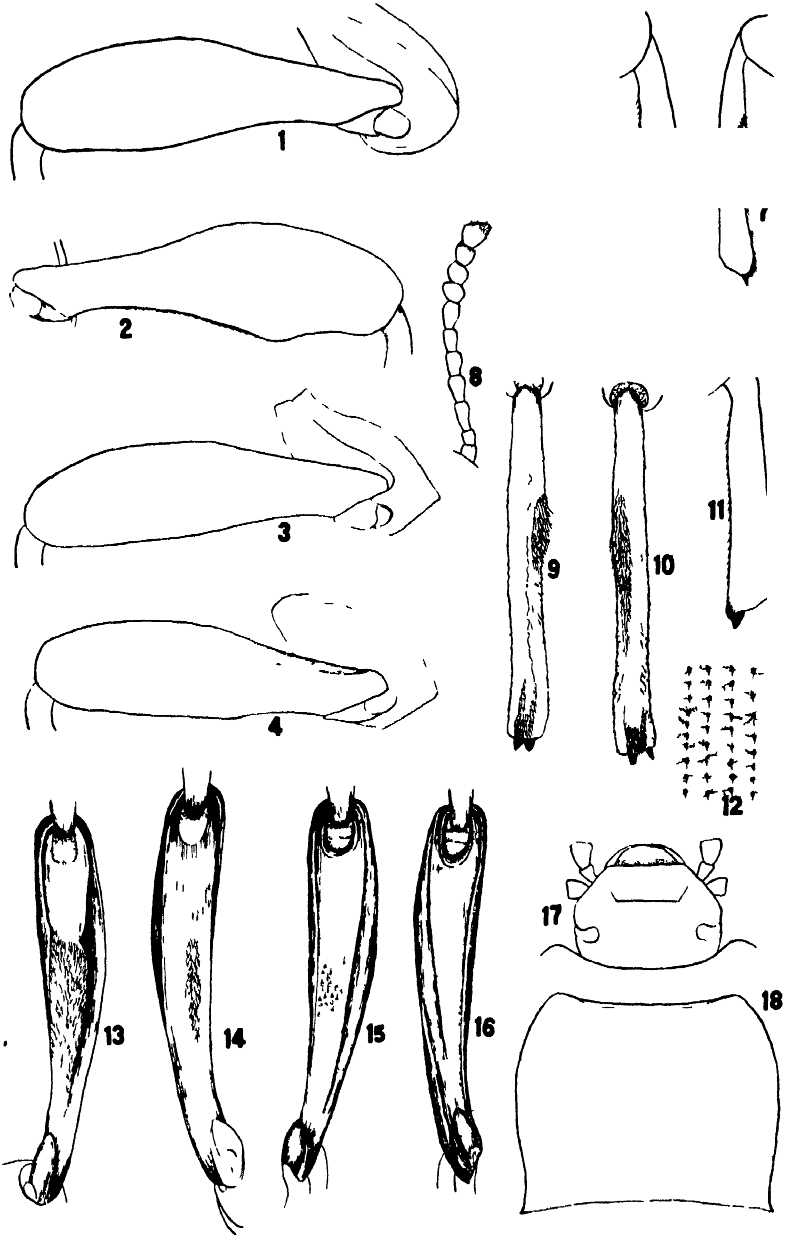
Fig. 11.—Dorsal view of genital segment of *Centronopus parallelus* Lec. female; P, dorsal plate of valve; Q, anus; R, paraproct of Tanner connate with the basale.

Fig. 12.—Dorsal view of genital segment of *Centronopus punctatus* new species, female.

Fig. 13.—Lateral view of genital segment of *Centronopus parallelus* Lec., female.

Fig. 14.—Lateral view of genital segment of *Centronopus wagneri* new species, female; S, paraproct connate with the basale.

Fig. 15.—Wing of *Centronopus* Sol., rudimentary in the species, measuring 8 by 3 mm.



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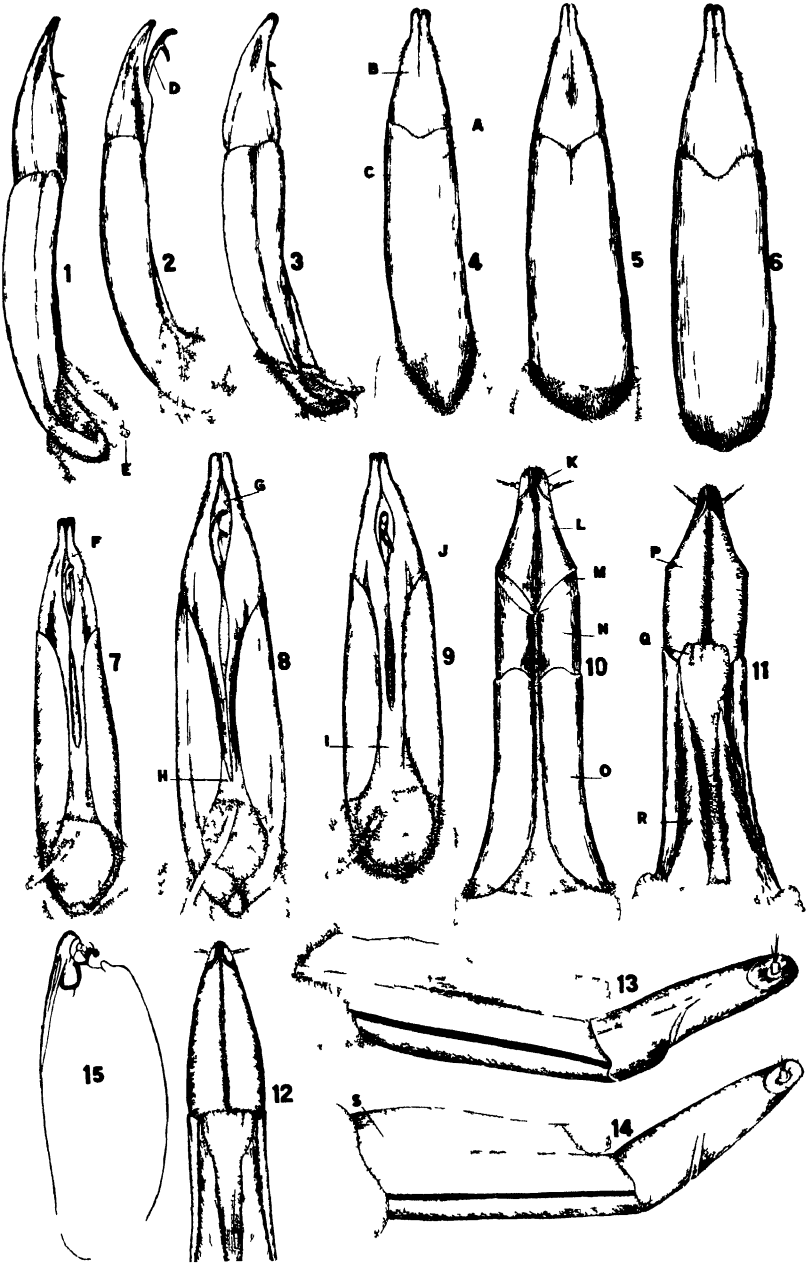

BLAISDELL AMERICAN CENTRONOPUS

PUPAL TRACHEATION AND IMAGINAL VENATION IN MICROLEPIDOPTERA

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I. INTRODUCTION

The researches of earlier writers, especially Comstock and Needham, the fundamental work of Comstock, and the more recent work of Tillyard, Lameere and Martinov have stimulated an interest in the study of pupal tracheation and vein homologies in all orders of insects. It was with the hope that the study of pupal tracheation in the more primitive members of the so-called Microlepidoptera might throw some light on the origin of the Heteroneurous type of venation as well as yield data on other problems of interest that this study was undertaken. To some extent this hope has been realized. The actual manner of reduction of the radial sector of the hind wing from the Homoneurous to the Heteroneurous type has been demonstrated in one family of the Microlepidoptera, the Gracilariidae.

The original plan of this paper included the selection for examination of phylogenetic series in each family. However, as the work progressed, it was found more feasible to select certain groups only or certain species when it seemed likely that their study would furnish data of significance. No effort has been made in these studies to trace the detailed development of tracheation and venation of individual species; rather the effort has been to figure and discuss features of tracheation and venation illustrated by selected forms. In the Gracilariidae, it has been possible to elucidate vein homologies hitherto overlooked and to trace the development of certain vein specializations.

The facts of pupal tracheation and resulting venation ascertained in this study are stated impartially, leaving for later studies the interpretation of their value as a basis for phylogenetic and taxonomic conclusions. Only occasionally are the theoretical considerations therein suggested followed up to any considerable extent; phylogenetic conclusions are not drawn except in rare instances. It must be borne in mind that any conclusions are of necessity based on the evidence at hand, and are subject to revision with a study of more complete phylogenetic series. It is evident that for an undoubtedly correct interpretation of vein homologies in families with reduced venation a study of complete generic series is necessary.

This investigation deals only with Microlepidopterous Heteroneura.[1] Following is a list of families and their representatives either studied or referred to in the paper:

Prodoxidae: *Prodoxus quinquepunctellus* Cham.
Adelidae: *Adela bella* Cham.
Incurvariidae: *Chalceopla cyanella* Bsk. *Paraclemensia acerifoliella* Fitch.
Cossidae
Tineidae
Lyonetiidae: *Hieroxestis. Oinophila. Proleucoptera smilaciella* Bsk. *Paraleucoptera albella* Cham. *Tischeria zelleriella* Clem. *Tischeria citrinipennella* Clem. *Bedellia somnulentella* Zell. *Opostega.*
Gracilariidae: *Gracilaria murtfeldtella* Bsk. *Gracilaria packardella* Cham. *Gracilaria purpuriella* Cham. *Ornix. Acrocercops strigifinitella* Clem. *Protolithocolletis lathyri* Braun. *Lithocolletis tremuloidiella* Braun. *Lithocolletis lucetiella* Clem. *Lithocolletis ostryaefoliella* Clem. *Lithocolletis fitchella* Clem.
Elachistidae: *Mendesia constantinella* Rebel. *Cycnodia. Elachista orestella Bsk. Elachista madarella* Clem.
Douglasiidae: *Tinagma. Douglasia.*
Scythridae: *Scythris impositella* Zell.
Yponomeutidae: *Atteva aurea* Fitch. *Yponomeuta multipunctella* Clem. *Zelleria celastrusella* Kearf.

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[1] I have followed Tillyard in using the terms Homoneura and Heteroneura for the two suborders of the Lepidoptera.

PLUTELLIDAE: *Plutella maculipennis* Curt. *Acrolepia incertella* Cham. *Argyresthia freyella* Wlsm.
GLYPHIPTERYGIDAE: *Brenthia pavonacella* Clem.
EUCOSMIDAE: *Carpocapsa pomonella* Linn. *Eumarozia malachitana* Zell. *Epiblema otiosana* Clem.
ETHMIIDAE: *Ethmia zelleriella* Cham.
OECOPHORIDAE: *Wingia lambertiella* Wing. *Depressaria.*
GELECHIIDAE: *Dichomeris. Gelechia cercerisella* Cham.
PYRALIDAE: *Pyrausta niveicilialis* Grt.

Of the forms examined, the venation of the genus *Prodoxus* (Prodoxidae)[2] is the most primitive, except in regard to certain features exhibited only in the hind wings of some Gracilariidae, and forms the basis of comparison with the other Microlepidoptera included in this study.

Dissections, in so far as possible, were made of pupae either of known age, or at a known period before emergence of the imago. In most instances, at least two dissections were made, one of an early pupa before the vein cavities were foreshadowed, the other of a pupa with vein cavities fully formed, and usually with pigment well developed in the scales. No great mechanical difficulties in carrying out this plan were experienced with any of the larger forms. However in the small reduced forms, the delicacy of the wings in early pupal life and their minute size render their removal from the comparatively heavily chitinized wing sheath extremely difficult without displacement of the tracheae. In later pupal life, the wings are easily withdrawn from the wing sheath, but unfortunately in these forms, the tracheae tend to abort in late pupal life, so that only the basal parts of the main stems may remain.

Dissections were made under water and the wings floated off onto a slide. The wings were first examined under the binocular dissecting microscope for the larger features and these drawn to scale. Examinations beneath a cover slip under a compound microscope with varying magnifications were made to determine the exact position of tracheal forkings and other details. It was found in the case of the very minute forms, that if the water was kept at a temperature near freezing, obscuring of the delicate features by fat was largely prevented.

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[2] The aculeate groups, Nepticulidae, Prodoxidae, Adelidae and Incurvariidae, agree in type of venation with the rest of the Heteroneura; they differ in the single sex-opening in the female and the uniformly aculeate wings, characters shared with the Homoneura. The three families, Prodoxidae, Adelidae and Incurvariidae, in my opinion, form the most primitive group of the Heteroneura, with a venation approaching that regarded as ancestral by other workers (Tillyard, 1919).

In the figures of pupal wings, single somewhat wavy lines represent tracheae, double dotted lines developing veins. In the imagoes, an effort is made to indicate relative degrees of chitinization and preservation of veins; continuous lines represent well-chitinized veins, the degree depicted by the heaviness of the line; dotted lines, veins without definite chitinization, aborted or obsolescent.

II. Basal Tracheation of the Pupal Wings

In all the forms examined, the alar trunk is complete. The median trachea arises about midway between the costo-radial and the cubito-anal groups, tending rather toward the costo-radial group. In the hind wings of *Gelechia* (Fig. 28) and *Yponomeuta* (Fig. 11) it is definitely associated with the costo-radial group. Only in the hind wings of *Plutella* (Fig. 5), *Gracilaria* (Fig. 67) and *Tischeria* (Fig. 61) is it associated with the cubito-anal group of tracheae. In some of the smaller forms examined and figured in this paper the exact points of origin of the main tracheae on the alar trunk could not be determined with certainty and hence these features are omitted from the figures.

In general the position of media closer to the costo-radial group, or midway between the two groups on the alar trunk is in keeping with the more generalized position of the families of the Microlepidoptera, as compared with the bulk of the other Lepidoptera. However it is difficult to reconcile the exceptional position of the median trachea in the hind wing of *Gracilaria, Plutella* and *Tischeria* with the generally accepted view that as specialization progresses, trachea M tends to migrate toward the cubito-anal group. None of these three genera can be regarded as specialized; in fact as regards the tracheation of the hind wings, *Gracilaria* is in other respects the most primitive form examined, its tracheation approaching that of the Homoneura. *Tischeria* conserves a notably primitive character—the aculeate wings. Views differ as to the phylogenetic position of *Plutella* with respect to other families, but by no worker is it considered high in the scale.

III. Basal Formations

Under the term basal formations are included those basal specializations, which are present in the more primitive forms in both pupal tracheation and imaginal venation, but as evolution proceeds tend to become obliterated in the imago or swallowed up in the heavy chitinization at the base of the wing. Their presence and composition in any but the most primitive Lepidoptera are only discernible with difficulty in the imagoes. The basal specializations described below are the cubito-median Y-vein, the cubito-anal Y-vein of the hind wing, and the anal Y-vein. My observations support the generally accepted view that the Microlepidoptera as a whole are low in the scale of Lepidopterous development.

Cubito-median Y-vein

The cubito-median Y-vein consists of an upper arm, the basal part of M_5, a lower arm, the basal part of Cu_1, and a fused distal stem, $M_5 + Cu_1$, in which the relative importance of the two components in the Lepidoptera is not determinable, but the more important element is probably Cu_1. For this reason the notation Cu_1 is used for the main stem of the Y and its distal forks are labeled Cu_{1a} and Cu_{1b} in all figures. For a general discussion of this vein and its evolution in the Panorpoid Complex and in the Lepidoptera see Tillyard (1919, pp. 554–560; pp. 562–565; p. 664). Tillyard concludes (1919, p. 564) that in the majority of the Lepidoptera "the evolution of the cubito-median Y-vein follows a single definite line, viz. the tendency to strengthen the upper arm, M_5, at the expense of the lower, Cu_1" In higher forms, M_5 and the distal part of Cu_1 are exactly aligned, so that the serial vein, formed from M_5 and Cu_1, runs in a straight line from its base to the secondary cubital fork.

In *Prodoxus quinquepunctellus*, fore wing (Fig. 1), the upper arm of the cubito-median Y-vein lies in a nearly transverse position, meeting the lower arm and the distal stem almost at right angles; the lower arm is somewhat more strongly chitinized. In the hind wing (Fig. 2), M_5 follows the more usual oblique course, and the resulting vein formation is of the normal Y-form; here also the lower fork is the more strongly chitinized. In *Adela bella*, fore wing (Fig. 3), this vein is of normal Y-form, with its lower arm the more heavily chitinized; in the hind wing, Cu_1 is heavily chitinized to the base, while M_5 is scarcely discernible. In two genera of the Incurvariidae examined the cubito-median Y-vein is present in both wings, but varies from equally strong chitinization of both arms in the hind wing of *Paraclemensia acerifoliella* to very weak chitinization of both arms in the fore wing of *Chalceopla cyanella.* In no instance is the upper arm more heavily chitinized than the lower. In the last-named species the mass of chitin at the base in the hind wing includes both arms of the Y.

The condition outlined above with the lower arm heavier is to be expected in these, the most primitive families. A survey of those examples of the remaining families studied shows the existence of a wide variety of conditions. The lower arm, Cu_1, may be more strongly chitinized (Figs. 8, 41, 42, 45, 49, 56, 65); both arms may have developed equally (Figs. 14, 15, 24, 39, 50, 60); both arms may weaken (Fig. 35), a condition also found in many Tineidae; or, particularly in the hind wing, this basal formation may have moved so close to the base of the wing as to be almost or quite obliterated by the heavy deposition of chitin. In this connection note Figures 9, 23, 30, 36, 40, 46, 57, 62, 66, and the Gracilariidae, Plate XVIII. In many of the Microlepidoptera, the basal structures are obscure due to weak chitinization of the bases of the main veins. In Tortricids, Cu and M are so close together at the base that no vein M_5 can be formed; furthermore, this basal formation has moved so close to the base of the wing that fusion takes place between the main stem of Cu and M_{1-4}, instead of between Cu_1 and M_{1-4}. Tillyard describes and figures this condition in *Carpocapsa* (Tillyard, 1919, p. 664); an identical condition exists in *Olethreutes* (*Eumarozia*) *malachitana* which I have examined.

In none of the broader-winged forms in which the cubito-median Y-vein is present as a definite and clearly defined structure is there exact alignment of M_5 and Cu_1; the nearest approach to this condition observed is in the fore wing of *Gelechia cercerisella* (Fig. 29) and in the fore wing of *Brenthia* (Fig. 35). An approach toward alignment may be brought about in the narrow-winged forms by the crowding together of the bases of the main veins and the narrowing of the angle of divergence of the arms of the Y-vein.

However in many such cases, the stronger chitinization of the lower arm of the Y shows that this alignment is a condition secondarily produced, and not an indication of higher phylogenetic position.

An examination of pupal wings shows that the pale band indicating the position of M_5 in the imaginal venation may appear before any other vein cavities are foreshadowed (Fig. 20). In the later pupal stages this as well as all other veins are foreshadowed, although not always indicated on the figures. In some instances the position of M_5 is indicated in the pupa by a pale banding (Fig. 28) or a defined border line of heavier chitinization (Fig. 67), but the vein in the imago can not be distinguished in the mass of chitin laid down at the base of the wing.

Trachea M_5 appears late in pupal life in both fore and hind wings of two of the forms studied, *Yponomeuta multipunctella* and *Zelleria celastrusella*. In the pupal fore wing of *Yponomeuta* within an hour or two of emergence (Fig. 12), trachea M_5 traverses the upper arm of the Y-vein, and extends along the main stem of the Y unbranched to the distal end of Cu_{1a} only. It is of smaller caliber than trachea Cu_1, which retains its dichotomy into Cu_{1a} and Cu_{1b}, these lying alongside trachea M_5 for about one-third the length of the Y-stem. In the hind wing of the same pupa (Fig. 13), M_5 is of smaller caliber than Cu_1, and extends but a very short distance into the main stem of the Y-vein. Trachea Cu_1 persists, supplying both Cu_{1a} and Cu_{1b}, but its branches do not reach the distal ends of the corresponding veins.

In *Zelleria celastrusella* (Fig. 18), a few hours before emergence, trachea M_5 of the fore wing is of large caliber and entirely replaces Cu_1, supplying both Cu_{1a} and Cu_{1b} to their distal ends; the remnant of Cu_1 persists for a short distance along the Y-stem. In the hind wing (Fig. 19), trachea M_5 is similarly of larger caliber than trachea Cu_1, replacing it and branching near the point of divergence of veins Cu_{1a} and Cu_{1b}; the upper branch is of fine caliber, and extends but a very short distance along the vein cavity, Cu_{1a}. The fact that in *Yponomeuta* (Fig. 13) these tracheae fail to reach the distal ends of the veins while still retaining their connection with cubitus shows that the shrinking back of these tracheal branches is in no way associated with their transfer to the median stem via M_5. This shrinking back or abortion of tracheae in late pupal life is of frequent occurrence in the Microlepidoptera, particularly in those forms with reduced venation, and is one of the factors which combine to render difficult a study of vein homologies in these forms.

A peculiarity of the primary cubital fork, observed in the fore wing of the Lyonetiidae and nowhere else, is the pronounced upward curve of trachea Cu_1 at that point (Figs. 54, 58, 59), which is reflected in the position and configuration of the succeeding vein in that family. In the genera of this family, Cu_1 lies near the middle of the wing, or even above the middle (*Oinophila*, *Opostega*), and is one of the most strongly, or sometimes the only strongly chitinized vein present. In the narrow-winged *Bedellia* this peculiarity is not evident (Figs. 63, 65). This upward curve of Cu_1 results, in two genera in which dissections were made, in an approximation of Cu_1 and the median stem, and a shortening of the upper arm of the Y-vein (Figs. 56, 60).

The Anal Veins

Of the three anal veins normally present in the Lepidoptera, the first and second enter into the composition of basal Y-veins of the fore and hind wings respectively, and are discussed below under those specializations. In the few Microlepidoptera in which a third anal vein can be distinguished in the fore wing of the imago, it lies close to the margin (Figs. 1, 14, 29, 35), where it may in the most primitive of the Microlepidopterous Heteroneura bound the reduced area of the jugal lobe (Fig. 1); it is in every instance simple. Its precedent trachea may show a short posterior branch as in *Prodoxus* (Braun, 1919, fig. 6) and *Yponomeuta* (Fig. 10).

In the hind wing the third anal trachea is branched in those broader-winged forms which have not suffered reduction of the anal area (Figs. 5, 7, 11, 13, 17, 21, 22, 25, 28, 32); it is three-branched in *Ethmia* only (Figs. 21, 22), a possible correlation with the expansion in the imago of the area supplied by it. In the imago of most of these forms, only the anterior branch is preserved, and it is often weakly chitinized or obsolescent (Figs. 9, 30); in *Yponomeuta* (Fig. 15) and *Ethmia* (Fig. 23) a short posterior branch may be detected near the margin. In *Brenthia*, in contrast with all the other forms examined, it is the posterior branch which is strongly chitinized and of unusual length (Figs. 34, 36), an evident correlation with the greatly expanded anal area in this genus. In forms in which there is a certain degree of narrowing of the wing, with the apical area in advance of the basal half in this respect, trachea 3A is simple and its succeeding vein may be weakly chitinized and often difficult to discern (Figs. 40, 42, 46, 48, 50).

In the forms with extreme narrowing of the wing, only one anal vein is present, which may or may not be preceded by a trachea (Figs. 55, 61, 62, 67, 68, 69, 70, 71, 72, 77). An example of the final culmination of this process is witnessed in *Bedellia* (Figs. 64, 66) where all anal tracheae and veins are absent.

Cubito-anal Y-vein of the Hind Wing

To form the cubito-anal Y-vein, 1A arches up to Cu_2, fuses with it for a short distance, then diverges and runs separately to the margin. Though an ordinal character in the hind wing of the Lepidoptera, it is distinguishable in the imago of the primitive forms only, but may be seen in the pupal tracheation of many Heteroneura. It is entirely absent in higher forms, and in many Microlepidoptera with narrow wings and reduced venation, because of the loss of both trachea and vein 1A.

In *Prodoxus,* the existence of this formation is shown by the course of trachea 1A persisting in the base of the imaginal wing (Fig. 2), but the vein structure itself is somewhat obscured by the heavy mass of chitin. In *Adela* it can be distinguished in the imago by careful examination; in a newly emerged specimen of *Paraclemensia* (Incurvariidae) the presence of the structure can be made out, but the persistent trachea 1A does not quite touch Cu_2.

In all other forms studied it is necessary to refer to pupal tracheation to determine whether the arching up of 1A to Cu_2 and fusion with it takes place. In most of the broader-winged forms (Figs. 7, 11, 17, 19, 21, 25, 28) and in some of the smaller reduced forms (Figs. 48, 55) trachea 1A shows the characteristic arching up toward Cu. It will be noted however that the point of contact or of closest approximation often lies very close to the primary cubital fork or even before the apparent forking. The explanation is the tendency for these formations to move toward the base of the wing and finally to be obliterated. It is part of the same process which has resulted in the Tortricids in the elimination of a separate M_5. Trachea 1A is absent in the pupa, and hence any indication of the formation is wanting in *Brenthia.* In many reduced forms of Microlepidoptera, trachea 1A as well as the vein it precedes is entirely absent (Figs. 61, 62, 64, 66, 67, 68, 77).

Anal Y-vein

Fore Wing.—In the fore wings of all forms examined, except the Gracilariidae, an anal Y-vein formed by the looping up of 2A to 1A is present, although it is in some instances difficult to discern because of the almost complete obsolescence of one or the other of its components in the imago. Figures 1, 3, 8, 14, 24, 29, 35 show the anal Y-vein with both arms strongly chitinized. In *Scythris* (Fig. 39), *Mendesia* (Fig. 41), *Elachista* (Figs. 45, 49), and *Bedellia* (Fig. 65) the upper arm of the Y, 1A, is the disappearing element; while in *Tischeria* (Fig. 60) 1A is strongly chitinized throughout its length, and 2A is distinguishable only as a diffuse thickening of the wing membrane which fails to connect with 1A. Turning to the precedent tracheation, we find that in all forms dissected, even when the upper arm is obsolescent, trachea 1A is of full length, attaining the wing margin except where this trachea in common with others has shrunk back in late pupal life (Figs. 54, 59, 75, 78); trachea 2A is reduced or absent. Only in *Brenthia* (Fig. 31) does trachea 2A extend for a distance alongside of 1A after looping up to it. Trachea 2A may be absent in the earlier pupa (Figs. 4, 10), and only grow out into the vein cavity after the veins are fully laid down. In a nine-day old pupa of *Yponomeuta,* trachea 2A traversed only one-half the length of the lower arm of the Y, but the vein formation was fully foreshadowed by pale banding. In *Yponomeuta,* just before emergence, trachea 2A just reaches 1A (Fig. 12). In *Plutella,* a few hours before emergence, trachea 2A fails to reach trachea 1A, although the vein cavities are completely formed. Trachea 2A is absent in *Elachista* (Figs. 43, 47) and *Bedellia* (Fig. 63), although in the imago, it is the lower arm or 2A which is strongly chitinized. In *Tischeria* (Figs. 58, 59) the trachea is present, but does not loop up to 1A; the vein is aborted. Both trachea and vein are absent in Gracilaria (Fig. 78) and Lithocolletis (Figs. 74, 75, 76).

Hind Wing.—The anal Y-vein of the hind wing, although obscured by heavy deposition of chitin in the imago, is shown by tracheal studies to be an almost universally present character (cf. Plates XII–XVI), being discernible by careful study in all forms except those in which 1A is absent (*Tischeria*, Fig. 62; *Bedellia*, Fig. 66; and the Gracilariidae, Figs. 68–72), or in which the veins of the anal area are obsolescent (Fig. 57).

The hind wing of *Yponomeuta multipunctella* (Figs. 13, 15) is especially noteworthy; the Y-vein is incomplete in that 2A after fusing with 1A for a short distance diverges from it. Turning to the pupal tracheation, we find in the 54-hour old pupa (Fig. 11) a short trachea 2A growing out along the course of the future vein cavity; an hour or two before emergence, this trachea just reaches 1A, and the divergent part of the developing vein cavity is without tracheal supply.

In the great majority of the examples where the anal Y-vein is present, trachea 1A in the pupa is of full length and trachea 2A reduced or absent. The only exceptions to this are found in *Plutella* where trachea 1A is absent in the 3-day old pupa (Fig. 5), and much reduced in the late pupa (Fig. 7) just reaching 2A which attains the wing margin; and in *Brenthia*, where trachea 1A is absent even in a pupa within one day of emergence, and trachea 2A attains the margin.

In the hind wing of *Olethreutes* (*Eumarozia*) *malachitana* (Olethreutinae) 2A is absent in a 4-day old pupa (Fig. 25) and had not appeared in an older pupa examined within a day or two of emergence; in *Epiblema otiosana* (Eucosminae) a short trachea 2A is present in the pupa. This condition is in exact contrast to that observed by Tillyard (1919, Text Fig. 89, and pp. 582, 664) in *Carpocapsa*, a representative of the third subfamily of the Eucosmidae, in which 1A is reduced. The dominance of one or the other constituent of the Y-vein is obviously without any taxonomic significance, since either condition may occur within the confines of a single family, and neither is characteristic of Tineid or Tortricid stock respectively.

Trachea 2A is absent in *Elachista* (Fig. 48), but a small basal Y-vein is present in the imago. In *Proleucoptera* (Fig. 55) the only trachea present is 1A, to judge from its arching up toward Cu_2; the anal veins are obsolescent (Fig. 57). In *Tischeria* (Fig.

61) and Gracilaria (Fig. 67) the only trachea present does not arch up toward Cu_2 and I have interpreted it and the resulting vein as 2A. In *Bedellia* (Figs. 64, 66) no anal tracheae or veins are present; in Lithocolletis (Fig. 77) no anal tracheae are present, but a weakly chitinized anal vein, 2A, may be distinguished (Fig. 72).

IV. SUBCOSTA AND RADIUS

Fore Wing

A strongly chitinized unbranched subcostal vein is present throughout the Microlepidoptera, and in most groups forms the support for the specialized wing-coupling apparatus. In *Brenthia* only (Fig. 35) a short humeral veinlet is present, which is preceded in the pupa by a trachea of small caliber arising separately from the alar trunk (Fig. 33).

In the primitive forms, radius retains its original forking into R_1 and R_s, the latter dividing dichotomously first into R_{2+3} and R_{4+5}, which in turn divide again. In the most primitive forms studied, the stem of R_{4+5} is a fairly strongly chitinized vein (Fig. 1); as development proceeds it tends to weaken and finally is completely aborted. However the stem of R_{4+5} and hence the radial cell may be preserved in one form and lost in a closely related form. This condition is well exemplified in the Plutellidae; in *Acrolepia* the stem of R_{4+5} is as strongly chitinized as the stem of R_{2+3}, while in *Plutella* (Fig. 8) it may be almost aborted. In *Argyresthia* the variation occurs within the genus. Preservation of the stem of R_{4+5} in some members of a group may be taken as an indication of the relatively generalized position of that group, but may not be used alone as an empirical character to determine the position of any genus.

In the pupal tracheation, some interesting features are revealed in the manner of forking of the radial sector. Tillyard (1919, p. 660) points out that "in Hepialidae [Homoneura], the original condition seen in *Belmontia* (text-fig. 63) and all archaic Trichoptera is retained, viz. that R_{4+5} forks close to *rf′*, R_{2+3} much more distad from it." In all Heteroneurous Lepidoptera, including the Cossidae, regarded by him as the most primitive of the present Heteroneurous line, he found the reverse to be true, *i.e.* R_{2+3} forks nearer to *rf′* than does R_{4+5}. With one exception the latter condition is the rule in all the Microlepidoptera I have examined. In the fore wing of *Gracilaria* alone (Fig. 78), R_{4+5}

forks nearer the base than R_{2+3}. (The location of the forking of each stem is indicated in the figure by an arrow.) The view that this is a true archaic character, and not secondarily produced by a splitting back of trachea R_{4+5}, is borne out by the forked condition of the radial sector of the hind wing of *Gracilaria* (Fig. 67), approaching the Homoneurous type.

Specializations in the mode of branching of the radial sector and modifications in the resulting wing venation occur. They seem in most instances to be correlated with the extreme narrowing of the wing which has taken place in many Microlepidoptera. In many narrow-winged forms, the crowding together of the main veins and their branches in the apical part of the wing has resulted in the stem of R_{2+3} and the basal piece of R_3 in the pupa lying close alongside of the stem of R_{4+5}, thus obliterating the radial cell and preventing the formation of the cross-vein *ir* (Figs. 63, 75). The initiation of this process is seen in *Argyresthia* (Fig. 52) where R_2 and R_3 for a distance after splitting lie close together and are crowded alongside of the stem of R_{4+5}. As a further specialization, R_3 loses its connection with R_{2+3} and arises from the stem of R_{4+5} (Figs. 37, 43, 47, 74). It is perhaps noteworthy that *Lithocolletis fitchella* (Fig. 74) is a more highly specialized species than *L. ostryaefoliella* (Fig. 75), in which R_3 still retains its original connection. In the imaginal venation the only suggestion of the means by which the radial cell has been eliminated is the extreme flattening out of the upper margin of what appears to be an areocel but is in fact the basal cell only (Figs. 45, 49, 63, 76). In this connection compare *Elachista* (Figs. 45, 49) with the immediately ancestral *Mendesia* (Fig. 41), in which the radial cell is preserved. Apparent loss of the radial cell [in Micropterygidae] may be brought about by the obliteration of the basal piece of R_3, so that R_3 appears to rise from R_{4+5}; then *ir* forms the base of what appears to be R_3 connecting it with the stem of R_{4+5}, and the radial cell is confluent with the costal space between R_2 and R_3 (Issiki, 1931, p. 1017).

In the pupal tracheation of *Pyrausta* (Pyralidae) (Fig. 51) R_{2+3} and R_{4+5} arise separately from the main stem of radius, as in the butterflies. The Pyraloid groups do not belong with the Microlepidoptera, and the figure is merely included here for its theoretical interest and its bearing on the disputed question of the origin and relationships of the butterflies (Tillyard, 1920).

Reduction in the number of branches of radius may occur; in general however, reduction of radius proceeds more slowly than reduction of either media or cubitus. An extreme exception is witnessed in *Opostega*, in which the whole of radius is obsolescent. Reduction most commonly occurs through the coalescence to the tips of R_4 and R_5; stages in this process may be observed in *Gelechia* (Fig. 27), *Argyresthia* (Figs. 52, 53), *Elachista* (Figs. 43, 45, 47, 49), *Bedellia* (Figs. 63, 65) and *Lithocolletis* (Figs. 74, 75, 76). It should be noted that vein coalescence in all these examples is in advance of tracheal fusion, although the tracheal forking has also moved nearer the margin. In *L. ostryaefoliella* (Fig. 75) trachea R_{4+5} branches near its tip but both branches lie close together in the same forming vein cavity; in *L. fitchella* (Fig. 74) trachea R_{4+5} is unbranched; the resulting vein, R_{4+5}, is simple in all species of the genus (Fig. 76). Further in the Gracilariidae there is a tendency toward the loss by obsolescence of R_1 (Figs. 74, 75, 76) and of the main stem of radius up to the position of the primary radial fork (Fig. 76).

Hind Wing

All existing Heteroneura have followed a single line of specialization with the final result that the only forking of radius is at the position of the primary radial fork; R_1 fuses distally with Sc (a condition not confined to Heteroneura alone, as it occurs also in the Micropterygidae and Hepialidae). The notation R_s has been used for the remaining fork of radius, but up to the present, no evidence has been presented to show how the reduction of the radial sector to an unbranched trachea and vein has been brought about. However, my observations on the pupal tracheation and comparative studies of imaginal venation in the Gracilariidae have demonstrated without doubt that in this family at least the reduction has been brought about not by the coalescence of all the branches of the radial sector into a single vein, but by the attachment of the distal end of R_{2+3} to $Sc + R_1$, with the formation of a serial vein, Sc & $Sc + R_1$ & R_{2+3}, and the coalescence of the two remaining branches, R_4 and R_5, into a single vein. Hence what appears to be R_s, is, at least beyond the position of the secondary radial fork, R_{4+5} only.

In a few species of the two most primitive genera of the Gracilariidae, *Gracilaria* and *Ornix*, the radial sector is branched; this extra branch leaves the stem of R_s just below the costal shoulder extending obliquely and then outwardly nearly parallel to costa, which it reaches at about three-fourths of the wing length (Figs. 68, 69, R_{2+3}). Long ago Stainton (1854), and more recently Spuler (1910), Busck (1914) and Ely (1917) noticed or figured this additional vein; interpretations of its homology have been offered by Spuler and Ely (*l.c.*), but without any actual evidence upon which to base their interpretations[3]; no effort was made to trace its fate in the course of evolution.

The pupal hind wings of *Gracilaria murtfeldtella* furnish the necessary evidence to determine the true homology of this vein, and comparative studies of venation in other species of *Gracilaria* and in *Acrocercops* show that it finally enters into the composition of a serial vein whose basal part is the base of Sc, whose middle part is $Sc + R_1$, and whose distal part is the longitudinal part of R_{2+3}; the basal piece of R_{2+3} from R_s to the serial vein then disappears. Figure 67 shows the tracheation and developing vein cavities of the hind wing of an 8-day old pupa of *Gracilaria murtfeldtella*. All the branches of media and cubitus are present, so it follows that the branched condition of the radial sector is a primitive condition and not the result of the capture of branches of media. The primary radial fork, *rf*, lies near the base of the wing; R_1 is a trachea of comparatively small caliber, running obliquely upward nearly meeting Sc, thence extending outwardly along the forming vein cavity, $Sc + R_1$, to the wing margin. The radial sector soon divides dichotomously—*rf'* lying not far beyond *rf*—into two tracheae of comparatively large caliber, R_{2+3} and R_{4+5}; R_{2+3} is a larger trachea than R_1. R_{2+3} and R_{4+5} lie alongside of one another for a considerable distance; R_{2+3} then diverges, extending obliquely upward thence bending outward; its distal part lies nearly parallel to costa and almost in a line with R_1. Before the divergence of R_{2+3}, R_{4+5} divides again, so that for a short space three tracheae lie alongside of one another in the same forming vein cavity. One of the branches of R_{4+5} is of very fine caliber and shortly shrivels; the remaining large trachea may therefore be either R_4 or R_5; the resulting wing vein I have labeled R_{4+5} (Fig. 68) since it is a reasonable assumption that the vein resulted from the complete coalescence of two originally separate branches of radius. Figure 68[4] shows the imaginal venation of the same species. Sc and R_1 fuse distally, as observed for all Heteroneura. The basal free part of R_1 is obsolescent, as is in lesser degree the entire basal part of the radial stem nearly to the secondary radial fork. R_{2+3} is a well-chitinized vein, though not quite as heavily chitinized as Sc + R_1. Note the bend in the radial sector just below the costal shoulder, where R_{2+3} is given off.

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[3] Both regard the additional vein as vein 11 (R_1), which is of course impossible, as R_1 is also present, distally fused with Sc.

Figures 69, 70, 71 illustrate phylogenetic stages in the process of the formation of the serial vein. In *Gracilaria packardella* (Fig. 69) there is no sign of the free basal piece of R_1; the oblique basal part of R_{2+3} near its point of separation from the radial sector is very weakly chitinized and indistinct; its longitudinal part is a well-chitinized tubular vein. In *Gracilaria purpuriella* (Fig. 70) the base of R_{2+3} has completely aborted and the proximal end of its longitudinal part has come to lie close alongside of the end of Sc + R_1. In forms showing this condition in the imaginal venation, trachea R_{2+3} is present in the pupa as in *G. murtfeldtella.* The hump in the radial stem, where R_{2+3} was formerly given off, still persists.

In a species of another genus of the family, *Acrocercops strigifinitella* (Fig. 71), the fusion of the proximal end of the longitudinal part of R_{2+3} with the end of Sc + R_1 is complete, with the formation of a single longitudinal vein, and there is in the imago no indication of composite origin. This longitudinal vein is therefore a serial vein, its basal part, Sc alone, its middle part, Sc + R_1, and its distal part, R_{2+3}. The portion, Sc & Sc + R_1, is always much the more heavily chitinized part; the distal end, R_{2+3}, in the most specialized genera of the family tends to become diffuse and hard to trace. The radial stem still shows a slight upward curve at the point where in earlier genera R_{2+3} was given off.

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[4] In the figures of imaginal wings of the Gracilariidae, well-chitinized veins are represented by continuous closely parallel lines; veins in decreasing degree of chitinization are represented by dotted parallel lines, single continuous lines, single dotted lines; the last represent aborted or scarcely discernible veins.

In *Lithocolletis* (Fig. 72) the serial vein, Sc & Sc + R_1 & R_{2+3}, is without evidence of composite origin; furthermore the upward curve of the radial stem below the costal shoulder has almost flattened out, and radius extends in a nearly straight line through the wing. An examination of the pupal hind wing in this genus (Fig. 77) shows that the modifications in venation produced during the phylogenetic development of the family have extended to the pupal tracheation. A single longitudinal trachea is the forerunner of the serial vein; the remnant of radius is reduced to an unbranched trachea, which, interpreted on the basis of the foregoing phylogenetic study, is either R_4 or R_5. Whether the trachea preceding the serial vein is of composite origin as is the vein, and formed by the capture of R_{2+3} by R_1 and that in turn by Sc, is difficult to decide without additional evidence. An alternate view based on the age-long interaction of tracheae and veins would be that the loss of the basal pieces of veins R_1 and R_{2+3} tends to be reflected back into the pupal stage, with complete loss of the corresponding tracheae in the pupa, although the serial vein in the imago still retains its greater length due to its original (phylogenetically) complex origin.

In rare instances, R_{2+3} is present in the female of *Atteva aurea* (Yponomeutidae); it appears as a cross-vein, running obliquely from the radial sector to a longitudinal vein, which would ordinarily be interpreted as Sc + R_1 (Fig. 73). Its course and position are exactly that of the oblique part of R_{2+3} in *Gracilaria*. But, whereas in the Gracilariidae the basal piece of R_{2+3} is lost with the attachment of the distal half of R_{2+3} end-to-end to Sc + R_1, it is preserved in *Atteva*. Apart from the presence of the oblique piece of R_{2+3}, there is no evidence that a third component enters. In a male specimen of *Atteva* examined, there is a short spur projecting obliquely backward from the longitudinal vein. These may truly be regarded as atavistic characters, rarely reappearing.

In two genera of the Cossidae, Turner (1918) figures an additional branch of radius in the hind wings, which he calls (*a*) and which is apparently homologous with the oblique part of R_{2+3} in *Gracilaria* and *Atteva*.

The radial sector of the hind wing in some genera of the Elachistidae and immediately allied families appears to be branched.

Studies of pupal tracheation and more thorough comparative study of imaginal venation of all the allied genera must be undertaken before any definite conclusion can be reached. No material for this study is available at present. It is the opinion of the writer however, that the assertion of the presence of R_{2+3} in *Tinagma* and *Douglasia* is due to a misinterpretation of vein homologies, brought about by the near-anastomosis of the radial and median stems. In *Mendesia* (Fig. 42) and *Cycnodia* an extra vein is present to be accounted for; if this vein is to be regarded as R_{2+3}, it places the secondary radial fork far distad of its position in any other Lepidopteron. In *Mendesia*, I have labeled these apical forks R_4? and R_5?, but the interpretation is very questionable. The bend in the radial sector near its tip in *Elachista* (Figs. 46, 50) suggests the immediate derivation of this genus from a form in which this vein was branched.

The interrelations of subcosta and radius in the hind wing of the Gracilariidae, and the demonstrated homologies of the resulting two veins nearest costa in this family open up a wide field for conjecture and theory. Specifically, has development followed the same course throughout all Heteroneura, with evidence of the process lost? Is the vein that has been labeled $Sc + R_1$ throughout the Heteroneura a serial vein with a third component, R_{2+3}, added; and is the vein regarded as R_s, R_{4+5} only? In the present state of our knowledge it is impossible to determine the existence or non-existence of such a course of evolution in other groups of Heteroneura, and hence evaluate such course of development phylogenetically.

The presence in some Cossidae of an additional vein, apparently R_{2+3}, and its distal fusion with $Sc + R_1$ would suggest a similar course of evolution in this primitive group. All authorities agree in regarding the Cossidae either as the most primitive family of the Heteroneura or rank it as correlated in development with the earliest forms of the Tineina. The occasional presence of a free basal oblique piece of R_{2+3} in *Atteva aurea* (Yponomeutidae) suggests the possibility of such a course of evolution in this family. In this connection the condition of both pupal tracheation and imaginal venation in *Yponomeuta* and *Zelleria*, more highly specialized members of the same family, lends some support to the idea, although the evidence is in no way conclusive.

In the pupa of *Yponomeuta* (Fig. 11) and of *Zelleria* (Fig. 17), trachea R_1 approaches Sc; the two tracheae lie close together, almost in contact for a space, then diverge, reaching the costa separately. Separate vein formation takes place around their divergent tips; the formation is very clear in *Yponomeuta* (Figs. 13, 15); in *Zelleria* (Fig. 19) the vein cavities toward costa are somewhat ill-defined, and the two elements are not sharply separated. The condition toward costa in *Zelleria* is almost identical with that in *Gracilaria purpuriella* (Fig. 70). It is therefore at least within probability that the free end of the trachea and vein labeled R_1 in the figures of *Yponomeuta* and *Zelleria*, is properly R_{2+3}, and that the vein labeled Sc alone is really $Sc + R_1$. We must in this case however postulate that following the fusion of the distal end of vein R_{2+3} with $Sc + R_1$, trachea R_{2+3} has become permanently attached to R_1. This is what the evidence indicates ultimately occurs in the Gracilariidae.

In order to assume that a serial vein, Sc & $Sc + R_1$ & R_{2+3}, is present in all Heteroneura, and that the free branch of radius remaining is R_{4+5}, it is only necessary to postulate that the attachment of the distal end of R_{2+3} to $Sc + R_1$, as observed in the imago of *Acrocercops* (Fig. 71), was preceded phylogenetically by a switching over first at metamorphosis of trachea R_{2+3} to trachea R_1 or to trachea Sc, depending on which was the longer, and that later the transfer became permanent even in early pupal life. In general this transfer must have become permanent very early in phylogeny, as there is no evidence of the process even in such primitive forms as *Prodoxus*, either in tracheation (Braun, 1919) or in imaginal venation (Fig. 2). In the absence however of definite proof of such a process of evolution in the great bulk of the Heteroneura, the conservative notation $Sc + R_1$ and R_s is retained for all families except the Gracilariidae.

It is remarkable that a very primitive condition of tracheation and venation should have been preserved in a family—the Gracilariidae—which exhibits the extreme of modification and specialization of larval structure among the Lepidoptera, and in its most specialized members, great reduction in imaginal venation. No similar condition is to be found anywhere among its assumed phylogenetic affinities; the family is apparently an early offshoot from the primitive stem, and nowhere among present-day derivatives of this stem is the original condition preserved, unless the few isolated examples cited previously may be regarded as such.

Throughout the pupal tracheation there is considerable variation in the relative lengths of Sc and R_1, but in general R_1 is the longer, as may be seen from an examination of the figures. In reduced forms, and particularly in the Lyonetiidae, a single trachea, usually of considerable length, precedes vein $Sc + R_1$; it is probable here that trachea R_1 has early lost its connection with the radial stem and become permanently attached to Sc in the pupa (Figs. 55, 61, 64).

In primitive forms the free basal piece of R_1 is strongly chitinized and the basally forked condition of $Sc + R_1$ is clearly evident (Fig. 1). A wide range of variation in the degree of chitinization of the free basal piece of R_1 occurs. Correlated with its weakened chitinization or obsolescence there is a tendency toward weakening of the radial stem up to the position of the primary radial fork or beyond, even to the position of the secondary radial fork (Figs. 9, 15, 26, 36, 42, 50, 62, 66, 68, 69, 70, 71, 72). In some instances the radial stem closely approximates Sc (Fig. 26) and may appear almost to fuse with it. The distance of the primary radial fork from base in the imago may vary. In the Gelechiidae, it lies about midway along the cell, and has the appearance of a cross-vein connecting the cell with subcosta; this feature has been used as a diagnostic character for the family.

V. MEDIA

Media divides dichotomously first into M_{1-4} and M_5. M_5 enters into the formation of the cubito-median Y-vein, already treated. M_{1-4} at the secondary median fork divides into M_{1+2} and M_{3+4}. These divide again. In the Lepidoptera, in all forms in which the venation is not regarded as reduced, M_1, M_2 and M_3 reach the margin separately, but M_4 fuses distally with Cu_{1a} forming with it the distal Y-vein of Tillyard's terminology; the only evidence of its presence in Lepidoptera is its short basal piece which connects Cu_{1a} with M_3.

In the most primitive Microlepidoptera studied, the main stem of M_{1-4}, and its two branches, M_{1+2} and M_{3+4}, are fully preserved, but less strongly chitinized than the other main veins (Fig. 1).

All stages, from weak chitinization to complete abortion of the stem of M_{1-4}, and its two branches within the basal cell may be observed. The condition in the fore wing of *Plutella* (Fig. 8) is that characteristic of the more generalized forms. Further stages in the reduction in the fore wing are shown successively in Figures 53, 56, 41, 45, 49, 60, 76, 24, 39, with complete abortion in *Brenthia* (Fig. 35) and *Bedellia* (Fig. 65) up to the limits of the basal cell. M_{3+4} usually aborts earliest; in *Argyresthia* (Fig. 53) the reverse is the case.

In general the hind wing lags behind the fore wing in the elimination of media within the basal cell; compare Figures 24 and 23; 35 and 36; 39 and 40; 41 and 42; 56 and 57; 65 and 66; 76 and 72. Occasionally, *e.g.* *Mendesia* (Fig. 42) the stem of media is not as weak as the obsolescent radial stem basad of the position of the secondary radial fork; in reduced forms in general the stem of media is none or but little weaker than that of radius (Figs. 50, 57, 62, 68, 69, 70, 71, 72). In *Bedellia* (Fig. 66) and in other genera of the Lyonetiidae it anastomoses distally with the radial stem. This is the culmination of the general tendency in the Lyonetiidae toward the crowding together of M_3 and M_{1+2} and their approximation to the radial stem.

In the pupal wings, in unreduced forms, the median trachea divides at what has been shown to be the secondary median fork into two branches, M_{1+2} and M_{3+4}; the former of these divides again. As already pointed out under the cubito-median Y-vein, a trachea M_5 occasionally develops late in pupal life. In none of the forms studied was a trachea M_4 observed.

A few peculiarities in the course of the median tracheal branches are noteworthy. In several of the forms studied, trachea M_{3+4}, in either fore or hind wing or both, lies close alongside of the stem of M_{1+2} and the basal piece of M_2 up to the limits of the basal cell (Figs. 18, 20, 21, 22, 25, 27, 28, 31 and Tillyard, 1919, Figs. 89, 90). This is obviously of no phylogenetic significance, as it may occur in one, and not in the other, of two allied forms (compare Figs. 12 and 18); the resulting vein configuration is the same in either case. It may however explain how the condition present in the pupa of *Scythris* may be brought about. In *Scythris* (Fig. 38) trachea M_2 in the hind wing has lost its connection with the stem of M_{1+2} and has switched over to M_3. The imaginal venation shows no evidence of this tracheal peculiarity; the outline of the discocellulars in this region is that which would result from the more primitive forking of M_{1+2} near the limits of the basal cell.

In the hind wing of the narrow-winged forms, particularly those with reduced venation, in which media may be reduced to a single longitudinal trachea, the stem of M_{1+2} approaches the radial sector (Figs. 44, 48, 55, 61, 64, 77); in the resultant venation, M_1 or M_{1+2} may be approximate or connate with R_s (Figs. 57, 62, 72) or stalked with it (Figs. 46, 50). In *Bedellia* (Fig. 66) anastomosis of the two stems extends from near base to a point beyond the limits of the basal cell if this were present.

Very little evidence of capture of branches of media by tracheal outgrowths from adjacent tracheae was observed; however as no complete studies of the changes taking place late in pupal life or at metamorphosis were made, it can not be said that changes comparable to those observed for *Wingia* by Tillyard (1919, pp. 668, 669) do not occur. It is probable in unreduced forms at least, that such captures of branches of media do take place. In the pupal fore wing of *Brenthia* within a day of emergence (Fig. 33) trachea M_1 has lost its original connection shown in the 18-hour old pupa (Fig. 31) and become attached to R_5. In *Proleucoptera* (Fig. 54) what appears to be trachea M_1 is attached to trachea R_5 and included in the same vein cavity with it. In *Elachista orestella* (Fig. 44) trachea M_3 is attached to trachea Cu_{1a} in the hind wing. No other instances of capture were observed, even in *Yponomeuta* dissected within a few hours of emergence. However there is in *Zelleria* in the hind wing of the 3-day old pupa (Fig. 17) a tracheal outgrowth along the course of the cross-vein *r–m* reaching M_1 and lying alongside of it for a distance; in an older pupa shortly before emergence (Fig. 19) this trachea is not present. Trachea R_s itself and the distal ends of tracheae M_1 and M_2 have aborted so that nothing comparable to that observed by Tillyard for *Wingia* is possible. Late in pupal life in *Zelleria*, a short trachea is seen growing out along *r–m* toward M_1 in the fore wing (Fig. 18). In many Microlepidoptera there is a tendency late in pupal life for the distal ends of the tracheae to abort to a greater or less degree, thus making impossible any tracheal studies of the distal half of the wing. The fore wing may be in advance of the hind wing in this respect (Figs. 59 and 61; 78 and 67); or *vice versa* (Figs. 12 and 13; 18 and 19). Under such conditions tracheal capture is impossible at metamorphosis and if it occurs at all must take place before the abortion of the tracheae in late pupal life.

Reduction in the number of branches of media is of common occurrence in the Microlepidoptera. This reduction may be brought about by the coalescence of two branches of media with one another, or of a branch of media with an adjacent branch of radius or of cubitus respectively; or by a gradual fading out or obsolescence. While the fading out process is not confined to the branches of media, there is a general tendency throughout the Microlepidoptera, shown even in the most primitive forms (Figs. 1, 2), for the branches of media to be less heavily chitinized than the branches of the other main veins. Both methods of reduction may be traced back to the loss of tracheal connection with the median stem due to its tendency to abort at metamorphosis.

Coalescence of M_1 and M_2 is one of the most common methods of vein reduction, especially in the hind wing; Figures 68, 71, 72 show successive stages in this process in the Gracilariidae. The pupal tracheation in *Lithocolletis* (Fig. 77) in which media is reduced to an unbranched trachea by itself gives no better clue to the means of reduction than the imaginal venation (Fig. 72). The pupal tracheation in the ancestral *Gracilaria* (Fig. 67), in which M_1 and M_2 lie together for a distance in the same vein cavity, and comparative studies of imaginal venation indicate the process.

Without complete series, either tracheational or venational or both, it is often impossible to determine with certainty how the reduction of media has been brought about, since tracheae may show the same degree of reduction as the veins.

In those Lyonetiidae figured (Plate XVII), M_1 and M_2 are regarded as united in the hind wing; where only a single trachea is present this is considered to be M_{1+2}. This interpretation is based (1) on the far basal position of the only median fork present in the pupal tracheation of *Proleucoptera* (Fig. 55) and hence regarded as *mf′*, (2) on a comparison with the venation of such genera as *Hieroxestis*, in which M_1 and M_2 are both present, and M_3 occupies a position homologous with that of the vein thus labeled in *Proleucoptera* (Fig. 57). Comparative study of other genera of the family indicates a correlation of the narrowing of the hind wing with the crowding up of M_{3+4} toward M_{1+2} which is already approximated to or anastomosed with the radial sector. This course of modification suggests that a revision in the interpretation of venation of the hind wing of the Lyonetiidae is necessitated; *i.e.* where two branches of media are present, they are M_{1+2} and M_3. It is to be noted that in *Proleucoptera* trachea M_3 is of fine caliber, and suggests the initiation of processes which will result in the loss of this vein.

In the hind wings of *Elachista*, media has only two branches; these are labeled M_1 and M_3. It is impossible without tracheational studies of allied genera—*Mendesia* in particular—to determine with certainty whether M_2 united with M_1, as is the general course in evolution, or whether it has followed the less usual course of uniting with M_3, seen in *Scythris* and described below. A comparison of vein configuration in *Mendesia* (Fig. 42) and *Elachista orestella* (Fig. 46) suggests the latter course. In the pupal tracheation of *E. madarella* (Fig. 48), M_3 retains its connection with the median stem; in *E. orestella* (Fig. 44) it is attached to Cu_{1a}.

In the hind wing of *Scythris*, veins M_2 and M_3 may be parallel, connate, stalked or coalescent to their tips. The species figured, *S. impositella* (Fig. 40), shows the condition in which these two veins are parallel. In the pupa of this species however M_2 is seen to have switched over to M_3; the gradual coalescence toward tip of these two tracheae will explain the generic tendency toward coalescence of the corresponding veins, a tendency which must have arisen very early in phylogeny of the genus, since it has become permanent in the pupa in a species where it is not indicated in the imago. Stalking or coalescence of M_2 and M_3 is unusual in the Microlepidoptera, but occurs in isolated instances in widely separated groups.

In the fore wing coalescence of M_1 and M_2 is of less common occurrence than in the hind wing. However in the Gracilariidae, media is finally reduced in the pupal tracheation to an unbranched trachea interpreted as M_{1+2} (Figs. 74, 75); the corresponding vein is labeled M_{1+2} (Fig. 76). This interpretation is based upon the condition in the immediately ancestral genus, *Protolithocolletis*, in which M_1 and M_2 are long stalked. In *Tischeria* (Figs. 58, 60) and in other Lyonetiidae, reduction of media is brought about by coalescence of M_1 and M_2; M_3 may be present (Figs. 58, 60) or absent. An interpretation of vein homologies in this family calls for a more extended study of tracheation and venation of phylogenetic series than is possible in the limitations of this paper. The interpretation presented in the figures represents the writer's conclusions from study of certain allied genera, and is subject to revision with further study. The family offers a fertile field for the investigator.

M_1 or M_{1+2} may fuse with R_5 or the stem of R_{4+5} in the fore wing or with R_s in the hind wing. In general this fusion is incomplete, M_1 and R_5 reaching the margin separately. Anastomosis between M_1 alone and R_5 or R_{4+5} in the fore wing is seen in *Elachista* (Figs. 45, 49) and Bedellia (Fig. 65); between M_1 and R_s in the hind wing in *Mendesia* (Fig. 42) and *Elachista* (Figs. 46, 50), between M_{1+2} and R_5 or R_{4+5} in the fore wing in *Tischeria* (Fig. 60) or between M_{1+2} and R_s in the hind wing. In the pupal fore wing of *Elachista* (Figs. 43, 47) trachea M_1 approaches trachea R_{4+5}, and extends alongside of it for a distance, then diverges, reaching the margin separately. In the imaginal venation of *Elachista orestella* (Fig. 45) the apparent cross-vein is the basal piece of M_1 much modified in direction. In *E. madarella* (Fig. 49) a longer basal piece of M_1 and short basal piece of M_2 may be distinguished. In *Tischeria*, trachea M_{1+2} approximates trachea R_5 alone (Fig. 58).

In *Proleucoptera*, fore wing (Fig. 54), the pupal tracheation indicates complete coalescence in the imago of veins M_1 and R_5 and the transfer of trachea M_1 in the pupa to R_5. Further study is needed to determine if this is the normal condition in this genus, and if a similar condition exists in any of the allied genera.

Reduction in the branches of media through coalescence may further be brought about by the union of M_3 with Cu_{1a}; the process is exactly identical with that which resulted in the earlier fusion of M_4 with Cu_{1a}. It is of frequent occurrence and all stages of the process may be observed, often within a single family, from approximation of M_3 to Cu_{1a} to final complete fusion of the two elements (*e.g.* Figs. 12, 36, 45, 49, 15). In *Elachista* their tracheae lie side by side in the same forming vein cavity, showing beyond question the manner of vein reduction (Fig. 43). Finally there may be no evidence either in pupal tracheation or imaginal venation to indicate formation of a single vein from two originally separate elements (Figs. 11, 13, 15); homologies in such cases must be based on comparison with related forms. The inter-median cross-vein (*im*) and the short basal piece of M_{3+4} when these are present extend between M_2 and $Cu_{1a} + M_3$, except where changes in direction of precedent tracheae have introduced additional elements (cf. *Elachista*, Figs. 43 and 45; 47 and 49). The hind wings of *Gracilaria* (Figs. 68, 69, 70) and *Acrocercops* (Fig. 71) show stages in this reduction. Finally in *Lithocolletis*, all trace of M_3 as a component element of the unbranched vein (either in pupal tracheation or imaginal venation) has been lost. As it is not possible to determine what part, if any, is taken by M_3, the notation Cu_1 alone is used for this vein. In the fore wings also in the Gracilariidae, comparative venational studies within the family indicate that M_3 has coalesced with Cu_{1a}.

Reduction in number of branches of media by obsolescence occurs principally in the Lyonetiidae, a family in which vein reduction in general commonly proceeds by obsolescence or evanescence rather than by coalescence. Variation from the normal degree of chitinization to almost complete obsolescence may be observed within the limits of a single genus (e.g. *Hieroxestis*). In *Bedellia* (Fig. 65) the space between veins Cu_1 and M_1 indicates the loss of the intervening veins by obsolescence rather than coalescence, which would result in a drawing together of the remaining veins. In the precedent tracheation media is reduced to a single trachea, which, because of its course, has been interpreted as M_1 alone. In the discussion of the interpretation of homologies in the reduced venation of the hind wing of the Lyonetiidae, it was pointed out that trachea M_3 in *Proleucoptera* (Fig. 55) is of very fine caliber and foreshadows the weakening of that vein. In *Bedellia* this trachea is completely lost (Fig. 64), although M_3 is present in the imago (Fig. 66); in this instance tracheal reduction has preceded vein reduction. Vein reduction by obsolescence may reasonably be assumed to be directly due to loss of tracheal supply.

VI. Cubitus

The primary cubital fork lies very close to the base of the wing, and in all but the more primitive of the Microlepidoptera is included in the heavy chitinization at the base of the wing. The rôle of Cu_1 in the formation of the cubito-median Y-vein, and of Cu_2 in the formation of the cubito-anal Y-vein have already been treated (Section III).

In two instances, *Ethmia*, hind wing (Figs. 21, 22) and *Brenthia*, fore wing (Figs. 31, 33) the tracheae are split back so that Cu_1 and Cu_2 arise separately from the alar trunk. One other specialization, already referred to, is the strong upward curve of Cu_1 at the primary fork in the Lyonetiidae, with the result that Cu_1 in many genera of the family lies along the longitudinal axis of the wing.

Cu_1 at the secondary cubital fork, both in pupal tracheation and imaginal venation, normally divides into Cu_{1a} and Cu_{1b}. In the tracheation the secondary fork (*cuf'*) lies much nearer the base than the corresponding forking in the venation, and in some instances is not far removed from the primary fork (Figs. 4, 6, 10). Both Cu_{1a} and Cu_{1b} are normally strongly chitinized veins, and in this respect may contrast with the adjacent branches of media (Figs. 1, 2, 8, 9, *et al.*). Cu_{1a} may coalesce with the adjacent branch of media, as already discussed under that vein. Trachea Cu_1 is unbranched in the pupa in the fore wing of *Scythris* (Fig. 37) and *Proleucoptera* (Fig. 54), and in both fore and hind wings of *Tischeria* (Figs. 58, 61), *Bedellia* (Figs. 63, 64) and *Lithocolletis* (Figs. 74, 75, 77). The unbranched vein resulting is regarded as formed by the coalescence of Cu_{1a} and Cu_{1b}, and the notation Cu_1 is used for it as well as for the precedent trachea. That intermediate stages in this process of fusion occur is evident from the occasional stalking of these veins (*e.g.* in *Dichomeris* and *Depressaria*). But no intermediate stages have been seen in the pupa comparable to those observed for R_4 and R_5. The demonstration of the reduction of Cu_1 to an unbranched condition involves a change from the usual interpretation of vein homology in certain instances, *e.g. Scythris*, in which the missing vein has been explained on the assumption of the coalescence either of R_4 and R_5, or of M_3 and Cu_{1a}; and *Proleucoptera*, fore wing, where M_3 is regarded as absent by some workers.

Occasional examples of the loss of a branch of Cu_1 by obsolescence may be observed in the fore wing. There is thus introduced the possibility that the unbranched condition of Cu_1 may, at least in some cases, be due to obsolescence of one of the components rather than to their coalescence.

An unusually perfect example of reduction by obsolescence is afforded by the hind wing of *Proleucoptera smilaciella* (Fig. 57). In the pupa trachea Cu_1 forks distally into Cu_{1a} and Cu_{1b} (Fig. 55). Casual examination of the imaginal wing discloses an apparently unbranched well-chitinized vein not quite attaining the margin; this vein has been generally interpreted as Cu_{1b}, with Cu_{1a} stated to be absent. Careful examination with light reflected at an angle shows both branches of Cu_1 present as faint creases in the wing, as well as M_4 connecting Cu_{1a} with M_3. In Figure 57 these obsolescent veins are indicated by dotted lines.

In none of the forms studied, is Cu_2 in the fore wing more than a weakly chitinized vein. In this respect even the aculeate forms, such as *Prodoxus* (Fig. 1), are less primitive than the Cossidae (Tillyard, 1919, p. 661). The tendency throughout is for the middle portion of this vein to abort. Near the primary fork it may show a considerable degree of chitinization (Figs. 1, 3, 14). In general its distal end is a fairly strongly chitinized vein; this is true even in many reduced forms (Figs. 1, 8, 24, 39, 41, 45, 49, 56). In *Brenthia* (Fig. 35) and the more highly reduced forms, particularly in the Lyonetiidae and the Gracilariidae (Figs. 60, 65, 76) it almost disappears.

Cu_2 is present in the hind wing as a moderately well-chitinized vein except in a few instances, although it may show a tendency to weaken toward base (Figs. 15, 23, 30). In *Brenthia* (Fig. 36) it shows merely as a faint line. In *Proleucoptera* (Fig. 57) it is weakly chitinized; in *Bedellia* (Fig. 66), scarcely discernible.

Cu_2 is preceded in the pupa by a trachea usually of full length, but in the fore wing of smaller caliber than Cu_1. It shows some tendency to abort late in pupal life, especially in those forms in which the vein fails to chitinize or nearly disappears (Figs. 33, 75, 78).

VII. CROSS-VEINS; TRANSVERSE VEIN, DISCAL VEIN OR DISCOCELLULARS[5]

The cubito-anal cross-vein (*cu-a*) is present in the fore wing of a few of the forms examined. In *Prodoxus* (Fig. 1) and in *Adela* (Fig. 3), both primitive aculeate forms, it is quite distinct; in the former lying just distad of the primary cubital fork, in the latter on the same level with it. The cubito-anal cross-vein may also be distinguished in *Plutella* (Fig. 8) and in *Yponomeuta* (Fig. 14), both comparatively generalized forms. The latter, *Yponomeuta,* exhibits characters in the relation of subcosta and radius of the hind wing, which may be interpreted as primitive (see Section IV, p. 247). Tillyard (1919) failed to find this cross-vein in any Heteroneura examined by him, and omits it from his figure of the archetype of the Suborder Heteroneura (Tillyard, 1919, text-fig. 103, p. 687), and expressly states it to be absent (Tillyard, 1919, p. 688).

The archaic configuration of the distal boundary of the radial and basal cells of the fore wing is retained in the most primitive forms such as *Prodoxus* (Fig. 1), and the separate elements effecting the closure of these cells may easily be distinguished. The radial cell or areole is closed distally by the inter-radial cross-vein, *ir*. Bounding the basal cell distally are the discocellulars which include the radio-median cross-vein, *r–m,* the basal piece of M_1, the basal piece of M_2, the inter-median cross-vein, *im* (closing the median cell, *mc*, when this is present), a short piece of the stem of M_{3+4}, and the basal piece of M_4 more or less modified in direction.

The progress of evolution results in a modification of the original configuration. The elements may not all be separately distinguishable. Finally, one or more of them may be eliminated through processes of readjustment in position of main veins or through anastomosis or coalescence of adjacent veins.

In the hind wings of the more primitive members of the Gracilariidae, although the radial sector branches into R_{2+3} and R_{4+5}, the cross-vein *ir* is not present. In the hind wing of all other

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[5] The above inclusive heading is used merely as a matter of convenience, since the closure of the cells involves not only true cross-veins but also pieces of main veins. The terms, transverse vein, discal vein and discocellulars, as used by different writers, are not exactly equivalent.

Heteroneura (with the possible exceptions noted elsewhere) the radial sector is unbranched, and neither cross-vein *ir* nor radial cell can be present.

The inter-radial cross-vein may be absent in the fore wing. In *Paraleucoptera* it has been lost by obsolescence. Its formation may be prevented by a partial fusion of R_3 with R_4 as in *Pyrausta* (Fig. 51), or by the crowding together of the branches of radius in the apex of the wing with the fusion of the stem of R_{2+3} and the base of R_3 with R_{4+5} in the imaginal venation (Figs. 45, 49, 65, 76).

The radio-median cross-vein, *r–m*, in the fore wing may be eliminated by the partial or complete coalescence of M_1 or M_{1+2} with R_5 or R_{4+5} (see Figures 45, 49, 56, 60, 65). The apparent cross-vein between M_2 and the stalk, $M_1 + R_5$ or $M_1 + R_{4+5}$, is the basal piece of M_1. If the coalescence takes place between M_{1+2} and R_5 or R_{4+5}, as exemplified by *Tischeria* (Fig. 60), the inter-median cross-vein, *im*, extends between the stalk $M_{1+2} + R_5$ and M_3. In the hind wings of the Gracilariidae, the radio-median cross-vein may be shortened or eliminated by the approach of M_1 or M_{1+2} to R_{4+5}. Figures 68, 69, 71, 72 illustrate the progressive shortening of this cross-vein, with practical elimination in *Lithocolletis*. In most Heteroneura the fusion takes place between M_1 or M_{1+2} and the radial sector.

The angle between the inter-median cross-vein, *im*, and the short piece of M_{3+4} widens and finally exact alignment of the two elements results. The limits of each element may sometimes be determined by the different degree of chitinization (Fig. 24). In most instances however, where exact alignment has been attained, the proportions of the two elements are indeterminable in the imago (Figs. 23, 35, 36, 41, 56, *et al.*) In many cases, M_3 is in alignment with the stem of M_{3+4}, as reference to forming vein cavities in the late pupa shows (Figs. 6, 7, 12); then the part played by the short piece of M_{3+4} is reduced to a minimum. In *Bedellia* a serial vein, apparently made up of the basal piece of M_1, the inter-median cross-vein and the basal piece of M_4 in exact alignment, extends between the stalk, $M_1 + R_{4+5}$, and the unbranched Cu_1 (Figs. 63, 65). In reduced forms, the inter-median cross-vein is commonly absent in the hind wing. It may have been lost by obsolescence, as seems likely in the Gracilariidae

(Figs. 68, 71, 72), or have been eliminated by a crowding up of M_{3+4} to M_{1+2} such as takes place in the Lyonetiidae (Fig. 66).

With approximation and coalescence of M_3 and Cu_{1a}, the short basal piece of M_4 is eliminated (Figs. 12, 15, 19, 36, 45, 49, 68).

VIII. Summary and Conclusions

It has been shown in the preceding pages that the more primitive of the so-called Microlepidoptera closely approach, both in pupal tracheation and imaginal venation, the hypothetical ancestral Heteroneura. Development within this line in general parallels that in other lines of Lepidopterous descent, as observed by other workers, except that reduction in size and narrowing of wings are additional factors affecting venation.

Reduction in the number of branches of main veins has taken place through coalescence of adjacent veins; the evidence of the process may or may not be preserved in the precedent tracheation. In coalescence of adjacent branches of the same main veins, the position of the tracheal forking also moves distad, but lags behind the vein coalescence; therefore a vein formed by complete coalescence of two adjacent veins may show evidence of its composition by the branched trachea included in the vein cavity. In coalescence of adjacent branches of different main veins, the two tracheae may come to lie side by side for the full length of the resulting vein; one element may later lose its original attachment. Finally the tracheae suffer the same reduction as the veins, and a single trachea only precedes the coalesced vein, giving no evidence of two elements in its composition.

Reduction in venation has also taken place through obsolescence of veins; there is some evidence to indicate that here the loss of tracheal supply is a causative factor and that tracheal reduction precedes vein reduction.

In reduced forms the tracheae, particularly in the fore wing, tend to abort late in pupal life after scale formation begins and the vein cavities are outlined, so that only the bases of the main stems remain.

Tracheational and venational studies of the relation of subcosta and radius of the hind wing show the means by which, in one group at least, the existing specialization characteristic of all Heteroneura has been brought about. In the Gracilariidae,

R_1 fuses distally with Sc, but the radial sector is branched in the most primitive forms. The reduction of the radial sector is brought about by the attachment of the distal end of R_{2+3} to Sc + R_1 (with loss of the basal piece of R_{2+3}) and the coalescence of the two remaining branches into a single vein. No parallel course of development has been observed elsewhere in the Lepidoptera. However the condition observed in certain members of the Yponomeutidae at least suggests the possibility of such a course. If development in the remainder of the Heteroneura has followed a similar course, the attachment of R_{2+3} to Sc + R_1 must have taken place very early in phylogeny, as it has become permanent in the pupa of even the most primitive forms.

Since in reduced forms, the tracheae suffer the same reduction as the veins, the examination of pupal tracheation of isolated forms may furnish no better clue to vein homologies than the study of imaginal venation. In fact, a comparison of an evolutionary series of adult forms will often solve problems of vein homologies as well if not better than a study of tracheation of isolated forms. In other words, comparative studies are as essential in pupal tracheation as in imaginal venation to determine the course of evolution. Only by a study of complete phylogenetic series, beginning with those forms in which tracheation and venation have suffered no modification or reduction, and including those in which the tracheation though unreduced indicates where anastomoses are taking place or which veins are becoming obsolete, and leading up to the most specialized and reduced forms can vein homologies be determined with absolute certainty and the actual process of evolution be traced in detail.

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EXPLANATION OF PLATES

PLATE XII

Fig. 1.—*Prodoxus quinquepunctellus* Cham., fore wing of imago. Note primitive characters, *e.g.* persistence of radial (*rc*) and median (*mc*) cells, presence of cubito-anal cross-vein (*cu-a*), configuration of discocellulars, strong chitinization of basal part of Cu_1 and its alignment with distal part. Only in the weakening of Cu_2 does it depart from the primitive. Remnants of pupal tracheae remain in bases of main veins.

Fig. 2.—*Prodoxus quinquepunctellus* Cham., hind wind of imago. Note presence of cubito-median Y-vein, with strong chitinization of lower arm, Cu_1, cubito-anal and anal Y-veins and median cell. Note that basal piece of R_1 has not acquired the appearance of a cross-vein, and is of almost equal importance with Sc.

Fig. 3.—Base of fore wing of *Adela bella* Cham., to show primitive condition of cubito-median Y-vein and presence of cubito-anal cross-vein.

Fig. 4.—*Plutella maculipennis* Curt., tracheation of fore wing of pupa between 3 and 4 days old, before any vein cavities are clearly defined.

Fig. 5.—*Plutella maculipennis* Curt., tracheation of hind wing of the same pupa. Note equal part played by Sc and R_1 in formation of the fused vein, $Sc + R_1$. R_1 is of slightly larger caliber than Sc. M belongs to the cubito-anal group. Note far distal forking of M_{1+2}, foreshadowing the partial coalescence of M_1 and M_2 in the imago.

Fig. 6.—*Plutella maculipennis*, fore wing of pupa a few hours before emergence. The dotted lines represent the pale bands which foreshadow the imaginal venation. Note a short trachea 2A, not present in the younger pupa.

Fig. 7.—*Plutella maculipennis*, hind wing of the same pupa. Note a short trachea 1A looping up to Cu_2; and humeral trachea, *hm*. Note absence of vein formation about the free basal part of R_1.

Fig. 8.—*Plutella maculipennis*, venation of fore wing. Note strong lower fork of cubito-median Y-vein, and its exact alignment with the distal part of Cu_1. A partially obsolescent cubito-anal cross-vein is present. Note obsolescent condition of stem of R_{4+5} and median stem with its distal forking.

Fig. 9.—*Plutella maculipennis*, venation of hind wing. Note complete atrophy of basal free piece of R_1 and obsolescence of base of radius. Vestiges of the median stem and of a short spur of M_{3+4} are preserved. Note stalking of veins M_1 and M_2. Basal formations, except the anal Y-vein, are almost obliterated by the heavy deposition of chitin.

Plate XIII

Fig. 10.—*Yponomeuta multipunctella* Clem., tracheation of fore wing of pupa about 54 hours old, before vein cavities are foreshadowed. Note position of secondary cubital fork, *cuf'*, close to base of wing.

Fig. 11.—*Yponomeuta multipunctella*, tracheation of hind wing of same pupa. Note distal divergence of Sc and R_1 and absence of trachea M_3.

Fig. 12.—*Yponomeuta multipunctella*, pupal fore wing within one or two hours of emergence. Note particularly trachea M_5 traversing the upper fork of the cubito-median Y-vein and extending distad along the main stem of the Y-vein; it is single throughout, supplying only Cu_{1a}. The remnant of trachea Cu_1, with its dichotomy into Cu_{1a} and Cu_{1b}, lies in the cavity alongside of it, and is of larger caliber than trachea M_5. Note close approximation of trachea M_3 and trachea Cu_{1a} in the region of the discocellulars and the resulting reduction and near-elimination of vein M_4. The vein cavities have formed but not all are indicated on the figure,

Fig. 13.—*Yponomeuta multipunctella*, hind wing of same pupa. Note incomplete fusion of Sc and R_1 distad, with Sc and R_1 running separately to wing margin. A short trachea M_5 traverses the upper arm of the Y-vein and lies alongside of Cu_1 for a short distance. Note short trachea 2A and the pale banding (shown by dotted lines) which foreshadows the formation of an incomplete anal Y-vein in the imago.

Fig 14.—Base of fore wing of *Yponomeuta multipunctella*, imago, to show equal strength of upper and lower forks of the cubito-median Y-vein, and weakly chitinized cubito-anal cross-vein.

Fig. 15.—Base of hind wing of *Yponomeuta multipunctella*, imago, to show weak chitinization of free basal part of R_1, free distal ends of Sc and R_1, equal strength of forks of cubito-median Y-vein, and incomplete anal Y-vein.

Fig. 16.—*Zelleria celastrusella* Kearf., tracheation of fore wing of 3-day old pupa.

Fig. 17.—*Zelleria celastrusella*, tracheation of hind wing of 3-day old pupa. Note tracheal outgrowth from R_5 to M_1, along course of future radio-median cross-vein.

Fig. 18.—*Zelleria celastrusella*, tracheation of fore wing of pupa a few hours before emergence. Note approximation of base of M_3 to stem of M_{1+2}; short tracheal outgrowth from R_5 toward M_1; large trachea M_5, supplying both Cu_{1a} and Cu_{1b}, with shriveled remnant of Cu_1. The formation of vein cavities in the region of the discocellulars is more advanced than elsewhere.

Fig. 19.—*Zelleria celastrusella*, tracheation and developing vein cavities of hind wing of same pupa. The development of vein cavities is more advanced than in the fore wing. Note disappearance or shrinking back of tracheae. Note large caliber of trachea M_5 supplying both forks of Cu_1.

PLATE XIV

Fig. 20.—*Ethmia zelleriella* Cham., tracheation of fore wing of an overwintering pupa dissected October 3. Imagoes emerge in April. M_{3+4}, shown in the figure closely parallel to the base of M_{1+2} and M_3, is actually almost in contact with them. None of the vein cavities except M_5 are foreshadowed at this time.

Fig. 21.—*Ethmia zelleriella*, tracheation of hind wing of overwintering pupa. The main cubital stem is split to the base, so that Cu_1 and Cu_2 arise separately on the alar trunk. Note close approximation of M_{3+4} to M_2, as in the fore wing.

Fig. 22.—*Ethmia zelleriella*, tracheation and developing vein cavities of hind wing of pupa a few days before emergence; dissection April 14. All veins strongly chitinized in the imago are foreshadowed as pale bands, though not all are shown on the figure. There is at this time no developing vein cavity around the free basal part of R_1; this vein is weakly chitinized in the imago. Note close approximation of M_3 to Cu_{1a} and consequent shortening of M_4.

Fig. 23.—*Ethmia zelleriella*, hind wing of imago. Note exact alignment in serial vein, *im* & M_{3+4}.

Fig. 24.—*Ethmia zelleriella*, fore wing of imago. Note vestiges of media within the cell. In discocellulars note exact alignment of *im* and M_{3+4}, but different degree of chitinization of the two elements.

Fig. 25.—*Olethreutes* (*Eumarozia*) *malachitana* Zell., tracheation of hind wing of pupa four days old. Note long trachea 1A and complete absence of trachea 2A. Contrast with the condition in *Carpocapsa* (Tillyard, 1919, Text-Fig. 89).

Fig. 26.—Base of costa of hind wing of *Olethreutes malachitana* to show relation of Sc and R_1.

Fig. 27.—*Gelechia cercerisella* Cham., tracheation of fore wing of late pupa. Note close resemblance to *Wingia* (Tillyard, 1919, Text-Fig. 90), a member of a related family.

Fig. 28.—*Gelechia cercerisella*, tracheation of hind wing of late pupa. Here also note resemblance to *Wingia*.

Fig. 29.—Base of fore wing of *Gelechia cercerisella*, to show alignment of M_5 and Cu_1, and weak chitinization of base of Cu_1. Remnants of the median trachea and trachea M_5 are preserved.

Fig. 30.—Base of hind wing of *Gelechia cercerisella*, to show strong chitinization of the free basal piece of R_1, the "bar" connecting the upper margin of the cell and subcosta, a characteristic of the family. Note almost complete obliteration of the cubito-median Y-vein by movement basad and heavy chitinization.

PLATE XV

Fig. 31.—*Brenthia pavonacella* Clem., tracheation of fore wing of pupa about 18-hours old, before beginning of development of vein cavities. Trachea Cu_2 is of fine caliber and arises separately from the alar trunk.

Fig. 32.—*Brenthia pavonacella*, tracheation of hind wing of 18-hour old pupa. Cu_2 is of very fine caliber; M_3 and Cu_{1a} lie almost in contact for some distance foreshadowing their stalking in the imago. Trachea 1A is absent; the posterior branch of 3A of unusual length, correlated with the great expansion of the anal area in the imago.

Fig. 33.—*Brenthia pavonacella*, tracheation of fore wing of pupa within one day of emergence. A humeral trachea is present. The condition of trachea Cu_2 foreshadows the almost complete abortion of this vein in the imago. M_1 has been captured by R_5. The vein cavities are all well developed though not shown on the figure.

Fig. 34.—*Brenthia pavonacella*, tracheation of hind wing of pupa within one day of emergence. Note obliquity and exact alignment of *im* and M_{3+4}. The forming vein cavity of the upper fork of the anal Y-vein is plainly discernible, though no trachea traverses it. No true vein formation takes place around the first fork of the third anal, but the posterior fork develops as a strongly chitinized vein.

Fig. 35.—*Brenthia pavonacella*, venation of fore wing. Note complete abortion of the stem of R_{4+5} and of M and its forks within the cell.

Fig. 36.—*Brenthia pavonacella*, venation of hind wing. Note expansion of anal area, and strongly chitinized posterior fork of 3A.

Fig. 37.—*Scythris impositella* Zell., tracheation of fore wing of 3½-day old pupa. Note separate origin of R_2 and R_3 from the radial sector, with complete elimination of the radial cell. Cu_1 is reduced to a simple unbranched trachea.

Fig. 38.—*Scythris impositella*, tracheation of costal and apical part of hind wing. Note extreme length of R_1 and switching over of M_2 to M_3.

Fig. 39.—*Scythris impositella*, venation of fore wing. Note extreme modification in direction of M_4 due to reduction of Cu_1 to an unbranched condition.

Fig. 40.—*Scythris impositella*, venation of hind wing. Note that the basal pieces of M_1 and M_2, forming part of the discocellulars, retain their primitive position and configuration in spite of the switching of the trachea preceding M_2 over to M_3 in the pupa.

PLATE XVI

Fig. 41.—*Mendesia constantinella* Rebel, venation of fore wing. Note narrowed radial cell. Cu_1 is strongly chitinized to base.

Fig. 42.—*Mendesia constantinella*, venation of hind wing. Note the branched radial sector.

Fig. 43.—*Elachista orestella* Bsk., tracheation of fore wing of late pupa. Note separate origin of R_2 and R_3 from radial sector. 1A is long and 2A absent, but note that in the imago it is the lower fork of the Y-vein (2A) which is strongly chitinized (cf. Figs. 45 and 49). Fig. 43A, details of branching of media and cubitus.

Fig. 44.—*Elachista orestella*, tracheation of hind wing of late pupa. Trachea M_3 is attached to Cu_{1a}; trachea M_2 is absent.

Fig. 45.—*Elachista orestella*, venation of fore wing. The interpretation of homologies in the discocellulars is based upon the course of the precedent tracheae.

Fig. 46.—*Elachista orestella*, venation of hind wing. Note kink in the distal end of the radial sector, suggesting an originally forked condition.

Fig. 47.—*Elachista madarella* Clem., tracheation of fore wing of pupa a few hours before emergence. 47A. Detail of branching of media.

Fig. 48.—*Elachista madarella*, tracheation of pupal hind wing. M_3 here retains its original connection with the median stem.

Fig. 49.—*Elachista madarella*, venation of fore wing.

Fig. 50.—*Elachista madarella*, venation of hind wing. Note open cell, due to failure of development of *im*.

Fig. 51.—*Pyrausta niveicilialis* Grt., tracheation of fore wing of 8-day old pupa. Note separate origin of R_{2+3} and R_{4+5} from the main stem of radius.

Fig. 52.—*Argyresthia freyella* Wlsm., branching of radius and media in fore wing of late pupa. Note that after the forking of R_{2+3}, R_2 and R_3 lie close together for a considerable distance and closely approximate the stem of R_{4+5}.

Fig. 53.—*Argyresthia freyella*, radius and media in imago. The stem of R_{4+5} basad of the discocellulars retains its distal forking; the position of the forks is the same as in species in which R_4 and R_5 are separate, not stalked beyond the cell.

Plate XVII

Fig. 54.—*Proleucoptera smilaciella* Bsk., tracheation of fore wing of late pupa. Note strong upward curve of Cu_1 at the primary cubital fork, bringing Cu_1 into near-median position in the imago. Media is reduced to a two-branched condition; the extra trachea attached to R_5 and running to margin along with it is interpreted as the missing branch of media, M_1; the resulting vein (cf. Fig. 56) is labeled $R_5 + M_1$, and lies in the normal position for M_1. Note also that M_2 is split near its distal end; this peculiarity was present in both fore wings of the pupa dissected.

Fig. 55.—*Proleucoptera smilaciella*, tracheation of hind wing of late pupa. Note single trachea preceding $Sc + R_1$; because of its length and form it is regarded as of composite origin.

Fig. 56.—*Proleucoptera smilaciella*, venation of fore wing.

Fig. 57.—*Proleucoptera smilaciella*, venation of hind wing. Note extreme obliquity of the intermedian cross-vein, *im.*

Fig. 58.—*Tischeria zelleriella* Clem., tracheation of fore wing of pupa about a week old. Note strong upcurve of Cu_1, bending of R_5 toward M_{1+2} beyond limits of cell, foreshadowing stalking in imago. Note far distal position of the secondary median fork, *mf'*, throwing some doubt on the correctness of the interpretation of homologies of the two forks.

Fig. 59.—*Tischeria citrinipennella* Clem., tracheation of pupal fore wing on day of emergence, showing the tendency of tracheae to abort late in pupal life; contract with condition in hind wing of same pupa (Fig. 61).

Fig. 60.—*Tischeria zelleriella*, venation of fore wing. Position of 2A faintly discernible.

Fig. 61.—*Tischeria citrinipennella*, tracheation of hind wing of same pupa to which the fore wing in Fig. 59 belongs; tracheae in hind wing of full length. Note absence of R_1 and downcurve of R_s toward the single median trachea in the middle of the wing.

Fig. 62.—*Tischeria citrinipennella*, venation of hind wing.

Fig. 63.—*Bedellia somnulentella* Zell., tracheation and developing vein cavities in fore wing of pupa two or three days before emergence. Note complete elimination of radial cell by approximation of stem of R_{2+3} and basal part of R_3 to stem of R_{4+5}, and their inclusion in the same vein cavity. Note single median trachea, peculiar bend in its course, and spacing, indicating obsolescence of tracheae, correlated with disappearance of veins by a fading out, rather than by coalescence.

Fig. 64.—*Bedellia somnulentella*, tracheation of hind wing of same pupa. Note single median trachea, although an additional vein still persists in the imago (Fig. 66).

Fig. 65.—*Bedellia somnulentella*, venation of fore wing. The veins are more distinct in this specimen than is usual; the usual condition is shown in Fig. 65A, where R_5 has almost or completely faded out.

Fig. 66.—*Bedellia somnulentella*, venation of hind wing. Note extra vein, M_3, not preceded by a trachea.

PLATE XVIII

Fig. 67.—*Gracilaria murtfeldtella* Bsk., tracheation and developing vein cavities of hind wing of 8-day old pupa. Note dichotomy of the radial sector into R_{2+3}, which does not divide again, and R_{4+5}, which forks before the divergence of R_{2+3} into a very fine short trachea, and a long trachea attaining the margin near apex. Note near-alignment of the distal end of R_{2+3} with R_1. Note approximation of M_3 to Cu_{1a} for a considerable distance and resulting anastomosis in imago.

Fig. 68.—*Gracilaria murtfeldtella*, venation of hind wing. Note strong chitinization of R_{2+3}, and weak almost obsolescent free basal piece of R_1. The stem of media is weakly preserved.

Fig. 69.—*Gracilaria packardella* Cham., venation of hind wing. This and the three following figures show successive stages in the attachment of the distal end of R_{2+3} to $Sc + R_1$, with the formation of a serial vein, and the straightening out of radius and elimination of the hump at the point where R_{2+3} was originally given off. Note also the progress of vein reduction in media and cubitus.

Fig. 70.—*Gracilaria purpuriella* Cham., venation of hind wing.

Fig. 71.—*Acrocercops strigifinitella* Clem., venation of hind wing.

Fig. 72.—*Lithocolletis tremuloidiella* Braun, venation of hind wing.

Fig. 73.—*Atteva aurea* Fitch, subcosta and radius of hind wing of an apparently atavistic specimen in which the basal piece of R_{2+3} is preserved, appearing as a cross-vein between R_s and the serial vein Sc & $Sc + R_1$ & R_{2+3}.

Fig. 74.—*Lithocolletis fitchella* Clem., tracheation of fore wing of overwintering pupa before beginning of development of vein cavities. (Dissected February 7.) Note absence of R_1 and separate origin of R_2 and R_3 on radial sector. Compare with Fig. 75, where the radial sector divides dichotomously.

Fig. 75.—*Lithocolletis ostryaefoliella* Clem., tracheation of fore wing of overwintering pupa at a somewhat later stage than shown in Fig. 74. Note elimination of radial cell and apical forking of R_{4+5}, with both forks included in the same vein cavity in the imago.

Fig. 76.—*Lithocolletis fitchella*, venation of fore wing. Note basal obsolescence of radius, and faintly preserved media.

Fig. 77.—*Lithocolletis lucetiella* Clem., tracheation of hind wing a few hours before emergence. Note reduction of the main tracheal stems to an unbranched condition. Instead of three separate tracheae, Sc, R_1 and R_{2+3} (cf. Fig. 67), a single unbranched trachea in the position of subcosta precedes the serial vein.

Fig. 78.—*Gracilaria murtfeldtella*, tracheation and developing vein cavities in fore wing of 8-day old pupa. The forking of R_{4+5} takes place at a point nearer the base than that of R_{2+3} (indicated on the figure by arrows).

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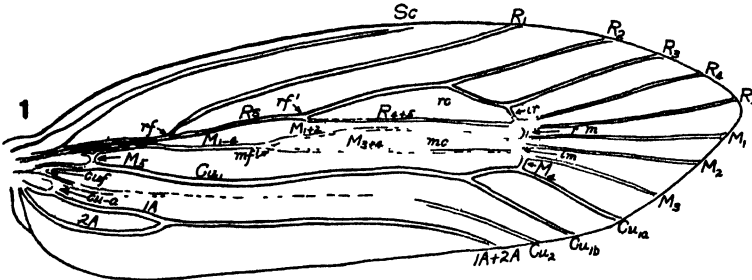

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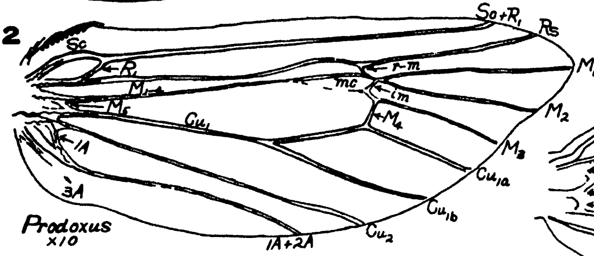

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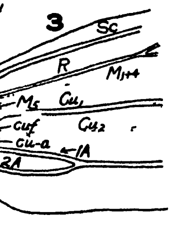

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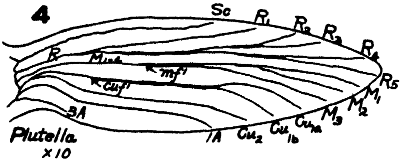

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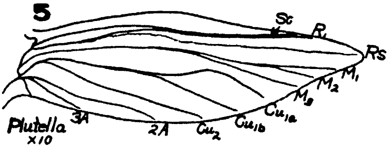

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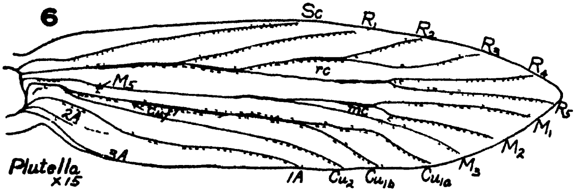

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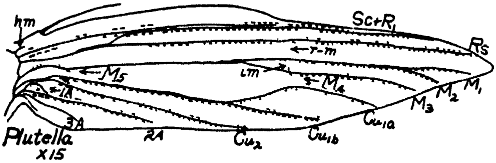

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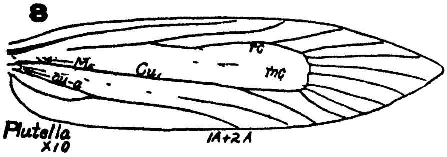

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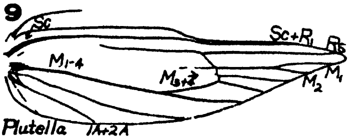

BRAUN—VENATION IN MICROLEPIDOPTERA

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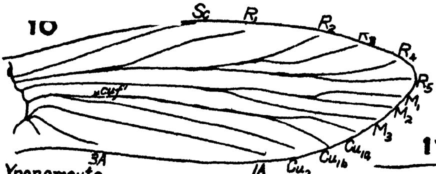

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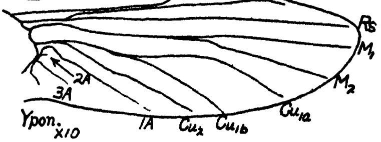

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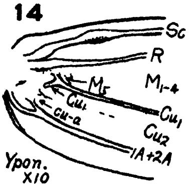

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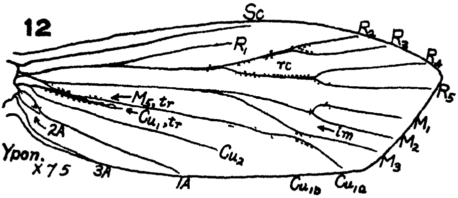

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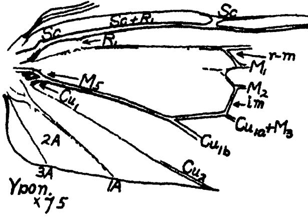

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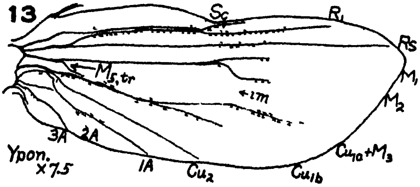

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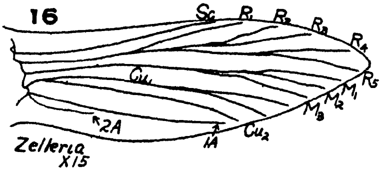

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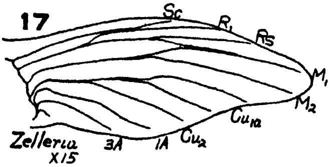

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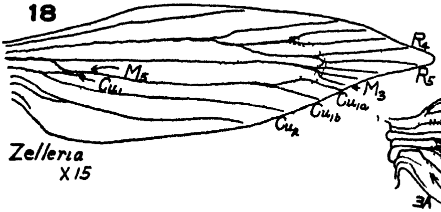

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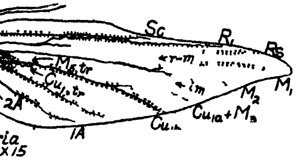

BRAUN—VENATION IN MICROLEPIDOPTERA

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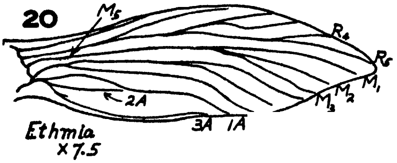

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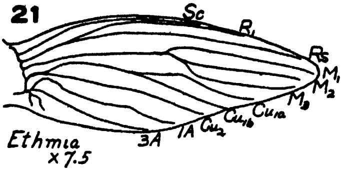

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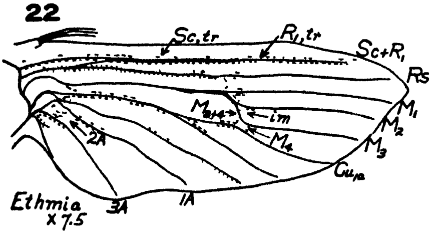

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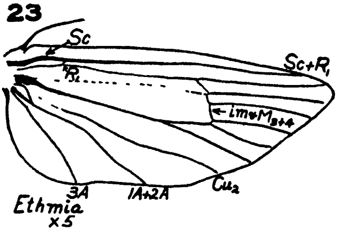

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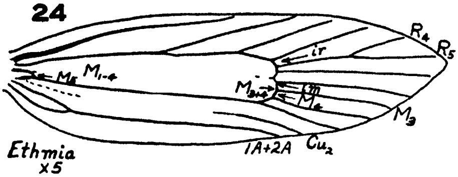

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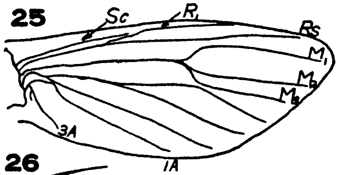

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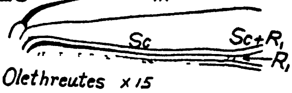

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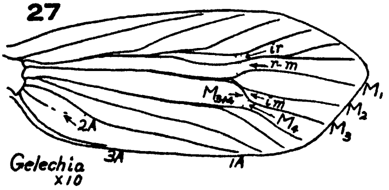

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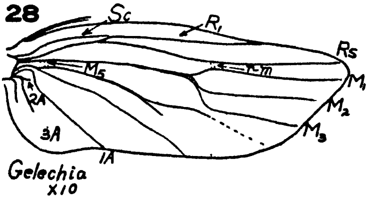

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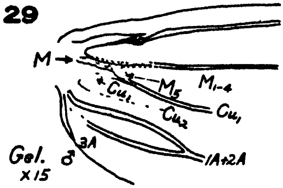

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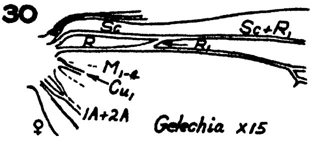

BRAUN—VENATION IN MICROLEPIDOPTERA

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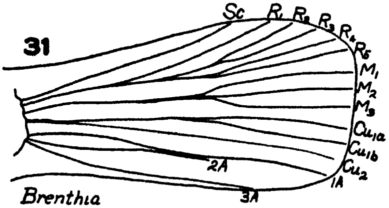

Brenthia

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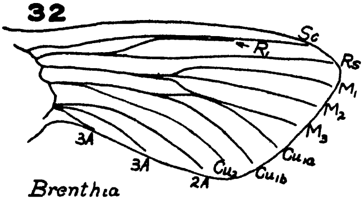

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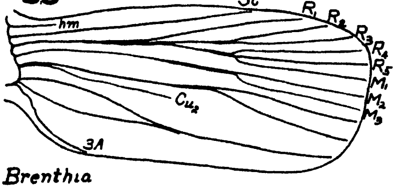

Brenthia
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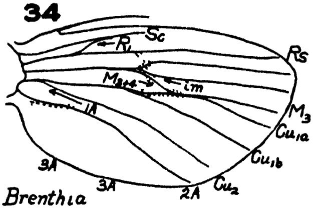

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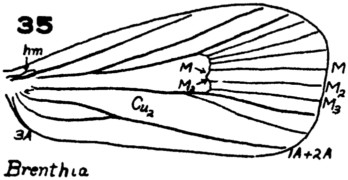

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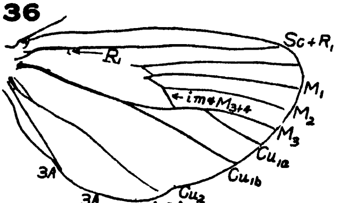

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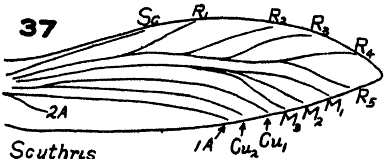

Scythris
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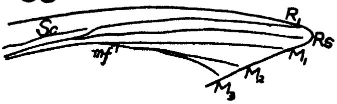

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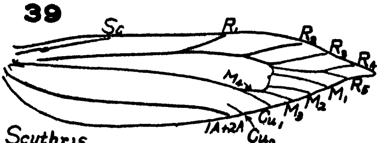

Scythris
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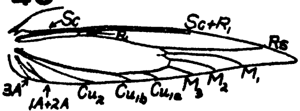

Scythris
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BRAUN—VENATION IN MICROLEPIDOPTERA

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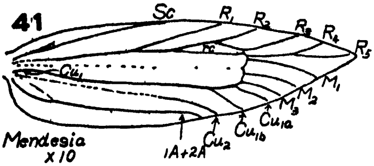

Mendesia
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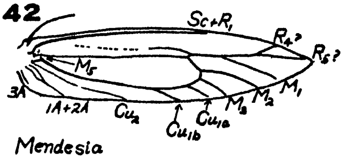

Mendesia
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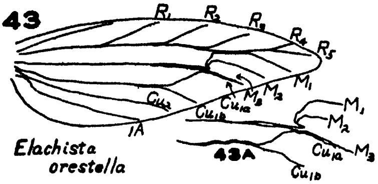

Elachista
orestella

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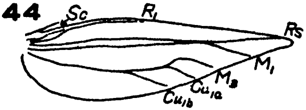

E. orestella

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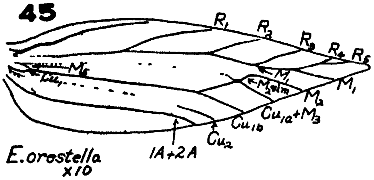

E. orestella
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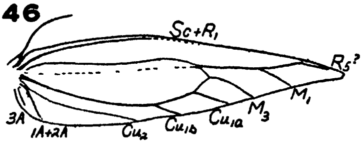

E. orestella
×10

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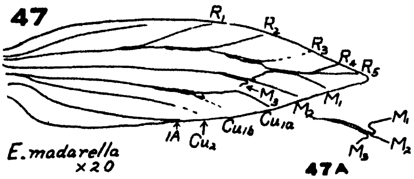

E. madarella
×20

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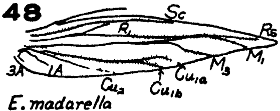

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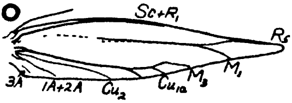

E madarella
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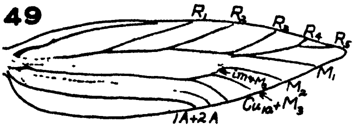

E. madarella
×15

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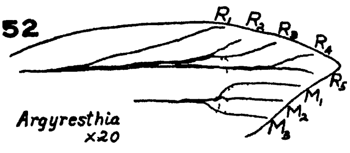

Argyresthia
×20

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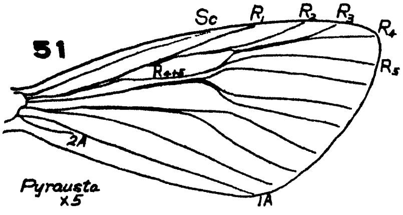
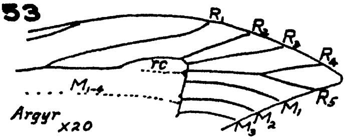


Pyrausta
×5

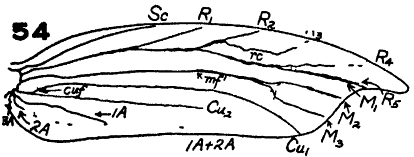
53



Argyr ×20

BRAUN—VENATION IN MICROLEPIDOPTERA

54



Proleucoptera X175

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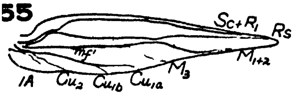
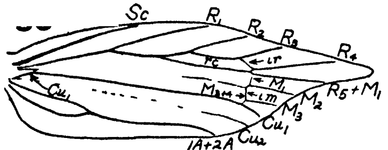


Proleucoptera X17.5



Proleucoptera x15

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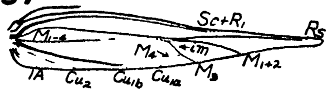

Proleucoptera x15

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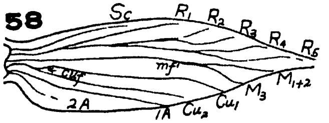
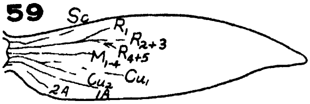


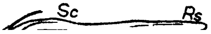
Tischeria zelleriella X12 5

59

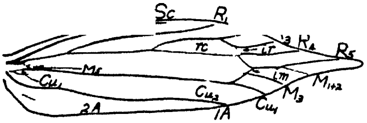


T citrinipennella X12 5

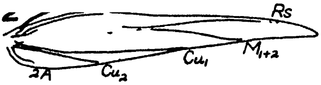
61



Cu_1 T.citrini. x12 5

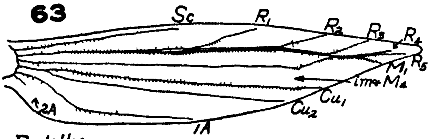


T. zelleriella X12.5



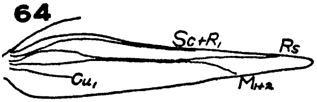
T citrini x12.5

63



Bedellia x15

64



Bedellia X15

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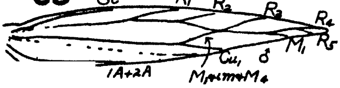
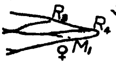


Bedellia X10

65A



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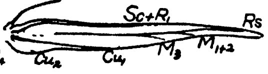
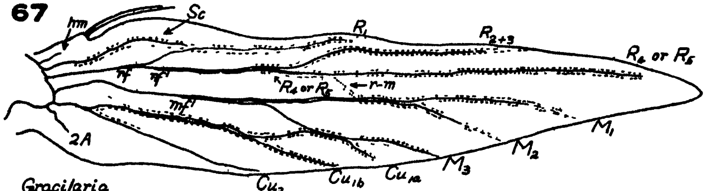


Bedellia X10

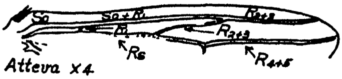
BRAUN—VENATION IN MICROLEPIDOPTERA

67



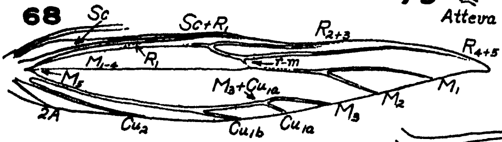
Gracilaria murtfeldtella x 15

73



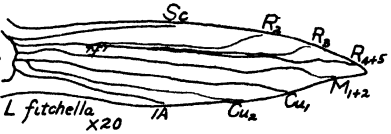
Atteva x 4

68



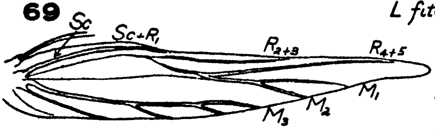
G. murtfeldtella x 10

74



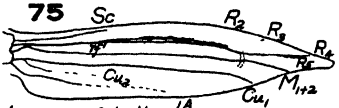
L fitchella x 20

69



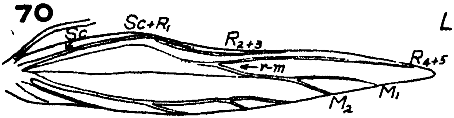
G. packardella x 15

75



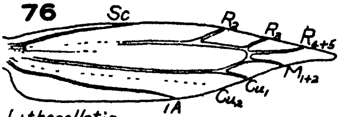
L ostryaefoliella x 20

70



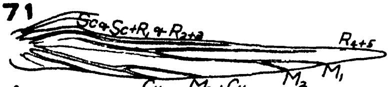
G. purpuriella x 15

76



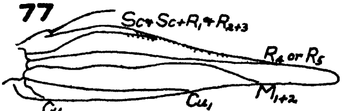
Lithocolletis x 15

71



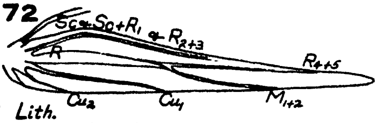
Acrocercops x 15

77



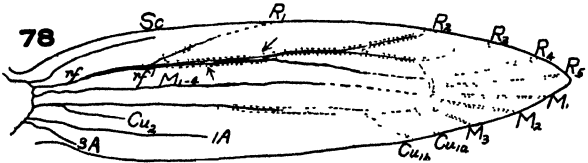
L. lucetiella x 30

72



Lith. tremuloidiella x 15

78



G. murtfeldtella x 10

BRAUN—VENATION IN MICROLEPIDOPTERA

KEY TO ALL KNOWN SPECIES OF THE GENUS TAENIOTHRIPS Amyot & Serville

(THYSANOPTERA: THRIPIDAE)

BY JOHN B. STEINWEDEN
San Francisco, California

(Plate XIX)

This large genus of Thysanoptera belongs in the suborder Terebrantia, superfamily Thripoidea Hood, family Thripidae Uzel, subfamily Thripinae Karny. It may be defined by the following characters.

Antennae eight segmented, style two segmented with paired sense cones on third and fourth segments, sixth segment with small, simple sense cone. (Fig. 7). Maxillary palpus three segmented. Prothorax with two long bristles on each posterior angle. (Figs. 1 & 3). Wings developed or rudimentary, sometimes wanting in males. Bristles on wings strong, two longitudinal veins present. End of abdomen with long bristles. (Figs. 5 & 6).

Dr. H. Priesner[1] includes several old genera in his conception of *Taeniothrips* and I have followed this arrangement. According to Dr. Priesner, the genus *Taeniothrips* corresponds to the genus *Physopus* Uzel with the exclusion of those species which bear one long bristle on each fore angle of the prothorax (*Frankliniella* Karny), and those others which have the fore tibia armed and have broad sense cones on the sixth segment of the antennae (*Odontothrips* Serv.). Included also is the genus *Pezothrips* Karny with its short-winged forms and the species of *Oxythrips* Uzel which have two bristles on each posterior angle of the prothorax. These latter species have been placed in the genus *Amblythrips* by Bagnall and Karny. *Taeniothrips* contains about one hundred and three species which constitutes a very large and probably unnatural group. Many species approach very closely some species of *Thrips* and Bagnall has placed several forms in

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[1] Die Thysanopteren Europas, 1928, p. 269.

both *Physothrips* (*Taeniothrips*) and *Thrips*, the only difference being in the number of segments of the antennae, *Thrips* having seven segments instead of eight. I have studied a series of specimens of one such form, *Thrips albipes* Bagnall, from China, and have found several specimens with one antenna seven-segmented and the other antenna of the same insect with eight segments. This peculiar condition raises some doubt as to the separation of *Thrips* and *Taeniothrips* on the basis of antennal segmentation.

Species from all parts of the temperate and tropical world are included in the genus *Taeniothrips*. They live in flowers and upon the leaves of various kinds of plants, and many spend part of their life in the ground or under leaves and fallen vegetation. Some species like *vulgatissimus* Haliday and *atratus* Haliday occur on many host plants, while others like *gladioli* M. & S. are confined to *Gladiolus* and a small group of related plants. Among the species of economic importance is the pear thrips, *T. inconsequens*, which is a serious pest on pear, prune, plum and cherry in the United States and Canada. The gladioli thrips, *T. gladioli*, is a major pest of gladiolus wherever it occurs and since its description in 1931 has been found in various parts of the United States, Canada, Australia, East Africa, and the Hawaiian Islands. Other species are of no economic importance, so that their identification is only of scientific interest.

In preparing this key several major groupings were used as follows: One group includes those species with the eyes strongly protruding, cheeks strongly arched, wings very long and well developed, fore-vein of fore-wing with three to nine distal bristles. (Fig. 1).

The second major group includes species with the eyes normal, not strongly protruding, cheeks not strongly arched, wings well-developed, the number of distal bristles on the fore-wing varying from one to many. (Fig. 3). This group includes the majority of the species and is further subdivided into four groups based on the number of distal bristles on the fore-wing, namely: one distal bristle, two distal bristles, three distal bristles, or four or more distal bristles. (Figs. 8, 9, 10, 12).

A third group includes a few species with the eyes normal, not strongly protruding, cheeks not strongly arched, wings rudimentary or wanting.

Morphological characters and chaetotaxy were used as much as possible and color was avoided unless it was impossible to find other distinguishing characters. Specimens from the same host and locality often vary greatly in color and sometimes fade in preserving solutions and slide preparations, so that other characters are more desirable to use. All known species of the genus *Taeniothrips* were studied, comprising a total of one hundred and three, of which nineteen were represented by types or type material, thirty more by identified specimens, and the remainder by original and other descriptions. No attempt was made to include varieties except in a few instances and the study and key is based almost entirely upon female specimens, due to the lack of sufficient male specimens and descriptions of males. This is unfortunate as a study of the males is important in preparing any key, but that will have to be left for the future.

My acknowledgments are due to Mr. Dudley Moulton who made this paper possible by his advice and aid, and by the use of his excellent collection and library. A representative series of the species here treated have been placed in the collection of The Academy of Natural Sciences of Philadelphia.

KEY FOR SPECIES OF TAENIOTHRIPS

Eyes strongly protruding; cheeks strongly arched; wings very long and well developed, fore-vein of fore-wing with three to nine distal bristles. (Figs. 1 and 12) .... **I** (p. 271).

Eyes normal, not strongly protruding; cheeks not strongly arched; wings well developed, number of distal bristles on fore-wing varying from one to many. (Fig. 3) .. **II** (p. 272)

Eyes normal, not strongly protruding; cheeks not strongly arched; wings rudimentary or wanting .... **III** (p. 292)

Ungroupable species .... **IV** (p. 293)

I. Fore tarsus with claw .... *inconsequens* Uzel, 1895 (Fig. 2)
(*calcaratus* Bagnall, 1916)[3]

Fore tarsus without claw. (Fig. 4) 1

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[3] This species cannot be separated from *inconsequens* by the description.

1. Very large form, total body length about 2 mm. Fore-wing with three or four distal bristles on fore-vein; antennae dark brown, with only segment III somewhat lighter; fore tibiae, hind tibiae, all tarsi lighter than rest of body; interocellar bristles long.... ......*major* Bagnall, 1916

Smaller forms, total length 1.2 to 1.76 mm. Comb on eighth abdominal segment complete......................2

2. Interocellar spines only about .032 to .04 mm. long. Antennae with segment II shading from brown to yellow distally, segment III yellow, IV yellow in basal fifth to half, V pale in basal fifth or thereabouts. Fore-vein of fore-wing with three to six distal bristles, hind-vein with fifteen to sixteen setae; outer spines on posterior angles of prothorax .072 to .08 mm. long, inner spines .084 to .088 mm., median spines of metanotum removed from anterior margin........... .... . *italicus* Bagnall, 1926

Interocellar spines longer, .06 to .093 mm............ . . .3

3. Interocellar spines placed within ocellar triangle; fore-vein of fore-wing with three to five distal bristles. Body color dark brown, antennal segments I, II, V to VIII dark brown, II at tip, III and basal portion of IV yellow, wings brown, lighter at base and in the middle. Interocellar spines about .078 mm. long, five short postocular spines; antennal segments III and IV equal in length, about 54 microns; hind-vein of fore-wing with nine to twelve spines; comb on eighth abdominal segment complete. . ...*picipes* (Zetter) 1828 (*primulae* Hal. 1836)

Interocellar spines placed on a line between the posterior ocelli, fore-vein of fore-wing with three distal bristles. Interocellar spines very long, about .093 mm.; segment IV of antennae subequal or slightly longer than III, IV .07 to .087 mm., III .068 to .078 mm.; prothorax with very long spines on posterior angles, outer spines .085 to 1.05 mm., inner spines 1.1 to 1.26 mm. Body color dark brown, antennae same except pedicel, extreme base and distal third of III, extreme base of IV and V which are lighter, being whitish to brownish yellow. *gracilis* Moulton, 1928

II. Fore-vein of fore-wing with one distal bristle. (Fig. 8)...A

Fore-vein of fore-wing with two distal bristles. (Figs. 9, 11)..... ....B

Fore-vein of fore-wing with three distal bristles. (Fig. 10). C

Fore-vein of fore-wing with four or more distal bristles. (Fig. 12)....................................D

A. Body color yellow.......... .. ..A1

Body color dark brown or at least with end of abdomen blackish brown, antennal segments I, II, VI, VII and VIII dark with VI lighter at base, III yellow, IV and V yellow at base, fore-wings clear at base, grayish brown in middle, gradually clearer toward the tip. Interocellar bristles very long, .073 to .078 mm.; eighth abdominal segment without comb.. ..... *frontalis* (Uzel), 1895

A1. Body color yellow, head greenish on fore margin and sides, pterothorax broadly brown colored on sides and a little greenish on anterior part, fourth and fifth abdominal segments dark brownish gray, antennae pale, segments I and II brownish, IV and V gray in outer third, following segments entirely gray, III 60 microns long, IV 70 microns long, legs entirely pale; wings with clear cross bands. Antennae nearly three times as long as head with segments conspicuously long and slender (Dutch East Indies).. ... . . . *taeniatus* Karny, 1923

Body color yellow or yellowish-gray, fore-wing light, not clouded or scarcely clouded (Java, (a gall forming species)) .... *traegardhi* (Trybom), 1911

B. Fore-wing with ten or more basal bristles on fore-vein which run out to distal portion of wing. (Fig. 11).... ...B1

Fore-wing with not over eight basal bristles on fore-vein which do not run out to distal portion of wing. (Fig. 9). B20

B1. Body color yellow or light brownish yellow...........B2

Body color brown or dark blackish brown or at least with end of abdomen blackish-brown B5

B2. Antennal segments III and IV subequal or nearly subequal in length... . . ..B3

Antennal segment III shorter than IV...... ... .B4

B3. Segment III longer than VI and much longer than II. Body color light lemon yellow, thorax and first two antennal segments slightly deeper shade, head and last two abdominal segments brownish golden-yellow; fore-wings clear except a faint bar at extreme tip and at median third (male)... ......*peculiarus* (Bagn.), 1918

Segment III subequal to VI in length. Body color light gray to yellowish-brown, pterothorax lighter and abdominal segments one to seven yellowish only slightly tinged with gray-brown; fore-wings light grayish yellow, with a lighter patch near apex and with basal third clear. *variabilis* Bagnall, 1913

B4. Segment III of antennae equal in length to II and much shorter than VI, III about .035 mm. long, only twice as long as wide. Antennae light grayish brown, ocelli clear without red pigment...........*crispator* (Karny), 1915

Segment III longer than II, slightly shorter than VI, III about .05 mm. long, slender, spindle-like, more than three times as long as wide; antennae yellowish-brown. *hospes* (Karny), 1914

B5. Small forms total body length from .9 to 1.2 mm.......B6

Larger forms total body length 1.2 mm. or over........B9

B6. Antennae dark in color except part or all of segment III which is light... ....B7

Antennae with two or more segments light in color.....B8

B7. Segment III of antennae dark except distal end which is yellowish, rest of III and IV dark brown, following segments unknown; all tibiae clear in distal half, at end together with tarsi faint yellowish; fore-wings brown. *thunbergiae* (Karny), 1923

Segment III of antenna yellow; fore-tibiae yellowish, other tibiae gray-brown, all tarsi yellow. *variabilis* (Bagnall), 1913

Segment III of antennae pale yellow, shaded with gray; fore tibiae pale yellowish, lightly shaded basally with gray-brown, other tibiae pale yellow at tips, all tarsi pale yellow; fore-wings gray-brown with basal fifth light. *minor* (Bagnall), 1921

B8. Antennal segments III, IV, V light brownish yellow, IV and V slightly darkened in outer parts, I, II, VI to VIII brown with tip of II somewhat lighter; fore tibiae brownish yellow, other tibiae dark brown except extreme tips which are light yellow, tarsi light yellow. *crassiconus* Moulton, 1930

Antennal segment III and basal half of IV whitish yellow, other segments gray-brown with II paler at apex; all tibiae yellow, tarsi pale yellow with a dark spot. *hargreavesi* (Karny), 1925

Antennal segments III to VIII light lemon yellow, distal half of all tibiae and all tarsi light lemon yellow. Four spines on posterior margin of prothorax, comb on eighth abdominal segment absent....*xanthocerus* (Hood), 1916

B9. Antennae entirely dark..........................B14

Antennae with one or more segments light in color.....B10

B10. Fore-tibiae yellow; fore-wings colored with two clear areas or cross bands, one at base and one before tip......B11

Fore-tibiae dark; fore-wings brown without clear areas or cross bands.......... .... .B12

B11. Fore-wings clear at base, then colored brown with a distinct clear cross band before tip. Antennal segments III and IV subequal in length, about 65 to 75 microns long, thick and spindle shaped, constricted at end, with large prominent sense-cones; comb on eighth abdominal segment incomplete............ .*distalis* Karny, 1913

Fore-wings clouded with light gray-brown near base, basal third clear, thence smoky-brown to tip excepting for an ill-defined clear patch at about distal fifth.
brunneicornis (Bagn.), 1916

B12. Very large species, total body length 1.7 mm.; III antennal segment 90 microns long, IV segment 97 microns long, antenna very slender; comb on eighth abdominal segment complete...... . ....*aeothiops* Hood, 1925

Smaller species, total body length 1.3 to 1.4 mm.; antennal segments III and IV shorter, antennae more slender..B13

B13. Antennal segment III about 45 microns long, segment IV about 80 microns long; fore-wing with 10 basal spines on fore-vein..... .... . .*antennalis* Karny, 1915

Antennal segment III about 75 microns long, segment IV about 68 microns long; fore-wing with fourteen or fifteen basal spines . ... *pingala* Ayyar, 1928

B14. Antennae with only segment III light in color...... B15

Antennae with more than segment III light in color...B18

B15. Fore tibiae and all tarsi yellow; fore-wings dark brown and clearer in basal half, but without light cross bands or clearer areas.... . . . *mjobergi* (Karny), 1920

Fore tibiae and all tarsi yellow; fore-wings dark, but with clear cross bands or clear areas B16

B16. Fore femur dark or at least darker than fore tibiae; fore-wings with a translucent cross-band toward base or with base nearly clear, and with a washed out band near end, which is sometimes very indistinct.
sjostedti (Trybom), 1908 (Fig. 11)

Fore femur yellow, tinged with brown..............B17

B17. Antennal segments III and IV approximately equal in length, about 60 microns long, III broadly fusiform, IV slightly more constricted apically. Posterior margin of prothorax with eight spines; comb on eighth abdominal segment incomplete; fore-wings with two distinct, clear cross bands............... ... *longistylus* Karny, 1923

Antennal segment III distinctly shorter than IV, relative lengths 15 and 23........... .*usitatus* (Bagnall), 1913

B18. Basal half of antennal segment III light yellowish brown, distal half of III and IV lighter than basal half; fore-wings grey-brown, without clear cross-bands or areas; fore femora basally and all tibiae distally shaded to pale yellowish-white, all tarsi yellow. Antennal segment IV long with a curious distal stem.
antennatus (Bagnall), 1914

Segment III of antennae clear yellow, IV and V partly yellow; fore-wings brown with clear cross bands or areas; fore tibiae at least partially yellow, all tarsi yellow. . . B19

B19. Extreme base of IV clear yellow, V with a white ring near base; fore-tibiae yellowish shaded with brown along upper and lower margins; wings whitish in basal fifth and with an indistinct lighter area before tip, but with no distinct cross bands. . . . . *formosae* Moulton, 1929

Segment IV clear yellow at base and at tip with a brown area between, V grayish-yellow in basal third, outer two-thirds dark grayish-brown; fore tibiae brown at base and on margins, but grayish yellow in middle, shading lighter towards tips; fore-wings grayish-brown at base, in the middle and at extreme tip and with two distinct light cross bands. Comb on eighth abdominal segment incomplete . . . .*varicornis* Moulton, 1928

B20. Body color yellow or light brownish yellow. B21

Body color brown or dark blackish-brown. B28

B21. Comb on eighth abdominal segment absent. B22

Comb on eighth abdominal segment present and completely set with teeth. (Fig. 5). B23

Comb not mentioned in description B27

B22. Fore-wing with five basal spines on fore vein and nine spines on the lower vein; interocellar spines long, .08 mm., with a row of postocular spines; spines at posterior angles of prothorax .073 to .08 mm. long, with six spines on posterior margin of prothorax. . . .*innocens* Uzel, 1895

Fore-wing with six spines on fore-vein and eleven to thirteen spines on hind-vein; interocellar spines indistinct, arising from sides of ocellar triangle; spines at posterior angles of prothorax about .045 mm. long, with four spines on posterior margin of prothorax.
xanthius (Williams), 1917

B23. Interocellar spines rather short, not over .028 mm. long, placed within ocellar triangle. B24

Interocellar spines longer, at least .034 mm., placed within ocellar triangle or on a line between the two posterior ocelli. B25

B24. Ocelli wanting; posterior margin of prothorax with only two spines; fore-wing with six basal spines on fore-vein and eight or nine spines on hind-wing. *albus* (Moulton), 1911 (Fig. 9)

Ocelli well developed, clear-red; posterior margin of prothorax with four spines, the median pair of spines on the metanotum placed close to the anterior margin; fore-wing with seven basal spines on fore-vein and thirteen spines on hind-vein. . . . . *albidicornis* Knech., 1923

B25. Posterior margin of prothorax with four spines. B26

Posterior margin of prothorax with six spines. Interocellar spines .034 mm. to .036 mm. long, placed on a line between the posterior ocelli; postocular spines absent or obscure. *niloticus* Priesner, 1930

B26. Total body length 1.33 mm.; ocelli yellow with brownish red crescents; interocellar spines .045 mm. long, placed within ocellar triangle, postocular spines absent or obscure; median spines on metanotum close to anterior margin; inner spines on posterior angles of prothorax .045 to .05 mm., outer spines .04 mm. *costalis* (Jones), 1912

Total body length 0.92 mm.; ocelli small and inconspicuous with colorless crescents; interocellar spines .054 mm. long, placed on a line between the two posterior ocelli, with four postocular spines; median spines on metanotum removed from anterior margin; spines on posterior angles of prothorax equal in length, about .05 mm. *albipennis* Moulton

B27. Body color straw yellow; thorax and sides of abdomen light orange yellow; antennal segment I clear yellow, II gray-brown with tip yellowish, III yellow, weakly colored in middle; IV to VIII dark brown, IV partly yellow at base; segments two to eight of abdomen each with a clear brown transverse stripe; wings almost colorless. Interocellar bristles long, dark, placed between the two posterior ocelli; fore-wing with seven or eight basal bristles and with a continuous row on the hind-vein. *glycines* Okamoto, 1911

Body color yellow or yellowish gray, fore-wing light, not clouded or scarcely clouded[8]. . *traegardhi* (Trybom), 1911

B28. Small forms, body less than 1.4 mm. in length. B29

Large forms, body more than 1.4 mm. in length; head wider than long, segment III of antennae shorter than segment IV. B38

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[8] No further description available.

B29. Antenna dark except for segment III which is yellow and the tip of II and the bases of IV and V which are sometimes yellowish.......... .... B30

Antenna not colored as above................ ..... B35

B30. With comb on eighth abdominal segment complete. (Fig. 5)...... .. .. B31

With comb on eighth abdominal segment absent. Interocellar spines long (about .075 mm.); prothorax with long bristles on the posterior angles, and with only four bristles on the posterior margin.
frontalis (Uzel), 1895.

B31. Antennal segment III round and bead-shaped, only about 32 microns long, IV about 48 microns long; prothorax with short spines on posterior angles (.024 to .036 mm.) and with ten short spines on the posterior margin; interocellar spines very short...... .*immsi* (Bagnall), 1926

Segment III longer, not rounded and bead-shaped; prothorax with longer spines on the posterior angles and with less than ten spines on the posterior margin; interocellar spines longer.... .... B32

B32. Interocellar spines .04 to .05 mm. long, placed within the ocellar triangle; prothorax with four or eight spines on the posterior margin, rather than six B33

Interocellar spines placed outside of ocellar triangle; prothorax with six spines on the posterior margin..... B34

Interocellar spines well-developed, placed between posterior pair of ocelli. Antennal segment III slightly longer than IV; comb on eighth abdominal segment complete and with long teeth.. . ...*setiventris* (Bagnall), 1918

B33. Prothorax with eight spines on the posterior margin and with the spines on posterior angles .06 to .076 mm. long, the inner ones longer than the outer; segment III of antennae spindle shaped, about 54 microns long, subequal in length to IV; two median spines on mesanotum placed close to anterior margin...*marshalli* Bagnall
(*ventralis* (Hood), 1918)

Prothorax with four spines on the posterior margin, and with the spines on posterior angles of equal length, about .05 to .06 mm. long; segment III of antennae broad, not constricted at end, 40 microns long, IV 40 microns long; two middle spines on mesanotum placed close to anterior margin. Segment III of antennae yellow, IV yellow, occasionally clouded with gray or brown.
salicis (Reuter), 1878

B34. Interocellar spines .068 mm. long; four or five postocular spines; segment III of antennae vase-shaped, about 54 microns long, IV about 49 microns long; spines on posterior angles of prothorax .073 to .084 mm. long, two middle spines on mesanotum placed close to anterior margin....... . ... . .*dianthi* Priesner, 1920

Interocellar spines only about .036 mm. long; five postocular spines, segment III very elongate and vase-like, 68 to 76 microns long, IV 64 to 66 microns long; spines on posterior angles of prothorax .09 mm. long, two middle spines on the mesanotum placed posterior to the anterior margin . ... *vulgatissimus* (Hal.), 1836

B35. Prothorax with four spines on the posterior margin...B36

Prothorax with six spines on the posterior margin. Antennae dark brown except apical fourth of segment III and IV and extreme bases of III to V which are paler; interocellar spines about .041 mm. long, placed within ocellar triangle, with three or four postocular spines; antennal segment III about 47 microns long, IV longer, about 54 microns; comb on eighth abdominal segment short and incomplete . *funestus* (Hood), 1915

Prothorax with eight spines on the posterior margin. (Fig. 3).... ...... B37

B36. Postocular bristles small except one clear pair behind eyes. Antennae with segment I gray, II, V to VIII dark gray, III yellow, IV yellow, occasionally clearly gray above; interocellar spines .045 to .05 mm. long, placed within ocellar triangle; prothorax with four spines on the posterior margin and with spines on posterior angles equal in length, about .054 to .06 mm. long; segment III of antennae broad, not constricted at end, 40 microns long, IV 40 microns long; two middle spines on mesanotum placed close to anterior margin....*salicis* (Reuter), 1878

Postocular bristles much more strongly developed, one pair behind eyes especially striking, being dark colored and about 35 microns long ......*latus* (Bagnall), 1912

B37. Antennae mostly dark in color, segments I and II grayish brown, III to VIII grayish-black, stem of III pale, body orange yellow, head and thorax inclined to orange-brown, extreme tip of abdomen dark gray-brown, legs yellow, lightly tinged with gray; antennal segment IV longer than III. .... *ericicola* Bagnall, 1927

Antennae with segments I and II dark brown, III and IV yellowish, base of V yellowish, apex light gray, VI to VIII dark gray; head longer than wide, segment III of antennae shorter than segment IV, (III 53 microns, IV 62 microns). Body color pale brown and yellowish, head and abdomen from fifth segment to apex dark brown, mouth-cone, thorax and basal segments of abdomen pale grayish yellow. Interocellar spines very long and placed in front of two posterior ocelli, with three or four long postocular spines............ *jonnaphila* Ayyar, 1928

B38. Comb on eighth abdominal segment incomplete; posterior margin of prothorax with ten spines; interocellar spines about .055 mm. long; segment III of antenna about 72 microns long, segment IV about 70 microns.
kellyanus (Bagn.), 1916

Comb on eighth abdominal segment complete; posterior margin of prothorax with six or eight spines; interocellar spines .065 to .068 mm. long; segments III and IV of antenna shorter than in *kellyanus*............... B39

Comb on eighth abdominal segment complete; posterior margin of prothorax with four spines; interocellar spines .06 mm. long, postoculars .048 mm.; bristles on posterior angles of prothorax, outer .073 mm., inner .062 mm.
latus var. *propinqua* (Bagn.)

B39. Posterior margin of prothorax with eight spines; segment III of antenna 63 microns long, segment IV 57 microns.
funtumiae (Bagnall), 1913

Posterior margin of prothorax with six spines; segment III of antenna 54 microns long, segment IV 49 microns.
dianthi Priesner, 1920

C. Body clear yellow, occasionally with dorsal shadings, but with end of abdomen not distinctly dark........ C1

Body color brown or dark blackish brown or at least with end of abdomen blackish brown.... .... .C8

C1. Small forms, total body length from .9 to 1.2 mm.... ..C2

Large forms, total body length over 1.2 mm...........C6

C2. Interocellar spines rather long, .032 mm. or over, placed outside of ocellar triangle.......................C3

Interocellar spines short, less than .032 mm., placed within or outside of ocellar triangle.......... ....C4

C3. Interocellar spines about .032 mm. long; prothorax with eight spines on the posterior margin and with spines on posterior angles .045 to .05 mm. long, median spines on metanotum placed close to anterior margin; comb on eighth abdominal segment present, but incomplete; total body length .9 to 1.1 mm.
frici Uzel form *alba* Priesner, 1926 (Figs. 3, 6)

Interocellar spines .058 to .062 mm. long; prothorax with six spines on the posterior margin and with spines on posterior angles .066 to .07 mm. long; comb on eighth abdominal segment absent; total body length .75 to .8 mm. Nearly always a wingless form which is distinguishable by the clear, yellow body color and the long dark body bristles....... . *pilosus* (Uzel), 1895

C4. Prothorax with six spines on the posterior margin; median spines on metanotum placed close to anterior margin; comb on eighth abdominal segment complete..... .C5

Prothorax with eight spines on the posterior margin; comb on eighth abdominal segment absent. Spines on posterior angles of prothorax short, outer spines .018 to .023 mm., inner .035 to .04 mm... *discolor* form *lythri* Karny

C5. Interocellar spines placed outside of ocellar triangle; III and IV antennal segments subequal in length, 56 to 62 microns; spines on posterior angles of prothorax long, .072 to .08 mm., outer spines on ninth abdominal segment .085 to .115 mm. long; spines on tenth segment about .1 mm. Body color highly yellow, thorax and often entire body with a reddish shading.
flavus (Bagnall), 1928

Interocellar spines placed within ocellar triangle; III and IV antennal segments equal in length, but shorter than in *flavus*, only about 45 microns; spines on posterior angles of prothorax shorter, about .054 mm.; apical setae of abdomen shorter, those on ninth and tenth segments about .08 mm.[4]......... .. .. *flavidus* (Bagnall), 1916

C6. Crescents of ocelli light brownish-yellow; body color uniformly light brownish yellow including legs, wings and all antennal segments except I which is whitish; interocellar spines short, placed outside of ocellar triangle, posterior margin of prothorax with six spines, comb on eighth abdominal segment complete with long teeth.
clarus Moulton, 1928

Crescents of ocelli crimson; body color yellow with some of antennal segments dark gray or brown; interocellar spines short, placed within ocellar triangle................C7

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[4] *Neavei* (Karny), 1925, belongs in this group, but the description is so meagre that it is impossible to place it in the key. It is described briefly as follows: Body color yellow, pterothorax slightly darker, orange yellow, distal abdominal segments somewhat shaded with gray, all legs very pale whitish-yellow, pronotum with short bristle-like hairs on whole surface, spines at posterior angles very long, about equal in length.

C7. Antennal segments I and II colorless, III light yellow with distal third gray-brown, IV dark gray-brown, yellow basally, V dark gray brown, with basal three-fifths light yellow, VI dark gray-brown, sometimes yellowish basally, VII and VIII dark gray-brown; III and IV about equal in length, about 60 microns; median spines on metanotum placed back of anterior margin; spines on ninth abdominal segment about 120 microns long, those on tenth segment about 114 microns.
flavidulus (Bagnall), 1923

Antennae pale yellowish-white to lemon-yellow, with segments II, IV and VI reddish-brown, IV yellowish basally, V tinged with reddish-brown distally; III and IV long, about equal in length, approximately 84 microns; median spines on metanotum placed close to anterior margin; outer spines on ninth abdominal segment about 165 microns long, those on tenth about 150 microns, ninth tergite of male with six stout dorsal spines, occasionally with tip of abdomen brown... ..*lefroyi* (Bagnall), 1913

C8. Large forms, total body length 1.4 or over............ .....C9

Smaller forms, total body length less than 1.4. . . . . .C17

C9. Interocellar spines short, not over .025 mm...... .. C10

Interocellar spines long, at least over .025 mm....... C12

C10. Body color lemon yellow to yellow, the abdomen shading to deep brown at the tip; antennae yellow with segments II, IV, VI reddish-brown, IV yellowish basally, V tinged with reddish-brown distally. Segments III and IV long, subequal in length, about 84 microns; interocellar spines very minute, about .008 mm., placed within ocellar triangle; comb on eighth abdominal segment complete.
lefroyi (Bagnall), 1913

Body color brown; antennae brown except III and portions of II and IV which may be lighter......... ... C11

C11. Interocellar spines about .016 mm. long, placed outside of ocellar triangle; comb on eighth abdominal segment complete; six postocular spines, six spines on posterior margin of prothorax. Body color uniform dark brown, antenna brown except for segment III which is entirely light grayish-yellow, II which is yellowish distally and IV which is yellowish basally; anterior legs wholly light, intermediate pair also light, but with fore margin shaded to deepish brown...... ......*andrewsi* (Bagn.), 1921

Interocellar spines minute, placed within ocellar triangle; postocular spines absent. Body color chestnut brown, antennae brown, but with segment II distally and III

lighter, the latter inclined to yellowish basally; fore tibiae yellowish distally, margins dark, legs otherwise dark.
longiceps (Bagn.), 1916

C12. Interocellar spines placed within ocellar triangle.... C13

Interocellar spines placed on a line between the posterior ocelli, comb on eighth abdominal segment complete..C14

Interocellar spines placed outside of ocellar triangle....C15

C13. Interocellar spines about .09 mm. long; postocular spines minute; antennal segment III about 73 microns long, IV about 63 microns; hind-vein of fore-wing with thirteen spines; comb on eighth abdominal segment complete. Body color bright yellow, with second, fourth, sixth and seventh abdominal segments fasciate with brown, ninth and tenth dark brown; fore-wings brown in second and last fourth. Color of antennae: I to III yellow, I and II darkened laterally with brown, IV yellow in basal two-fifths, remainder brown, paler at apex; V yellow in basal third, remainder brown, VI brown in basal third, remainder and VII, VIII mouse gray.
pictus (Hood), 1916

Interocellar spines about .078 mm. long; five short, postocular spines; antennal segments III and IV equal in length, about 54 microns; hind-vein of fore-wing with nine to ten spines; comb on eighth abdominal segment complete. Body color dark brown, antennal segments I, II, V to VIII dark brown, II at tip, III and basal portion of IV yellow; wings brown, lighter at base and in the middle. (Total body length 1.2–1.65 mm.; also in key for small species. See p. 287.)
picipes (Zetter), 1828

C14. Interocellar spines very long, about .093 mm.; segment IV of antennae subequal or slightly longer than III, III about 68 to 78 microns, IV 70 to 87, VI very long, about 81 microns, slightly longer than III, VIII, 18 microns; spines on ninth abdominal segment are 180 to 195 microns; those on ten about 190 microns. Body color dark brown, antennae same except pedicel, extreme base and distal third of III, extreme base of IV and circle at base of trichome and base of V which are lighter, whitish to brownish yellow.............. *gracilis* Moulton, 1928

Interocellar spines from .060 to .08 mm. long; antennal segment III about 76 to 87 microns long, slightly longer than IV, VIII shorter than above, only about 12 to 14 microns; spines on posterior angles of prothorax .09 to .1 mm. long; hind-vein of fore-vein with twelve to fourteen spines. Eyes strongly protruding, cheeks arched.

Body color dark brown, antennae same except segment III which is light brown.......*orionis* Treherne, 1924
pingreei Moulton, 1927[5]
tahoei Moulton, 1927

C15. Comb on eighth abdominal segment incomplete. (Fig. 6)..... ... . .C16

Comb on eighth abdominal segment complete. (Fig. 5). Interocellar spines about .036 mm. long; five to six postocular spines; spines on posterior angles of prothorax about .09 mm. long; six spines on posterior margin of thorax, the innermost pair long, about .054 mm.; median spines on metanotum removed from anterior margin; spines on ninth and tenth abdominal segment 130 to 140 mm. long.... .....*vulgatissimus* (Hal.), 1836 (Fig. 10)
(*meridionalis* Priesner, 1919)[6]
(*italicus* Bagnall, 1926)[7]

C16. Head .12 mm. long, .15 mm. wide; cheeks normal not arched; interocellar spines about .045 mm.; antennal segments III and IV short, about 55 microns; spines on posterior angles of prothorax about .066 mm. long; fore-vein of fore-wing with eight, hind-vein with thirteen or fourteen basal spines... ....*kotoshoi* Moulton, 1929

Head larger, .156 mm. long, .175 mm. wide; cheeks arched; interocellar spines one-half the length of eye; antennal segments III and IV long, III 72 microns, IV 70 microns; spines on posterior angles of prothorax about .09 mm. long; fore-vein of fore-wing with seven, hind-vein with about seventeen basal spines...*maculicollis* (Hood), 1918

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[5] The interocellar spines and the spines on the prothorax of the female holotype of *pingreei* are shorter than those of *orionis*, but a study of a series of specimens leads to the conclusion that there is too much variation to separate the two species on these characters, and therefore they are probably synonyms. Only the male holotype of *tahoei* Moulton is known, but it approaches very closely the males of *orionis* and *pingreei*. Until the females of *tahoei* can be studied, however, it does not seem best to declare *tahoei* a synonym.

[6] *Meridionalis* is identical with *vulgatissimus* in color and arrangement of spines, the antennae is narrower, otherwise they are the same. Body length 1.2 to 1.4 mm., also in key for small specimens. See page 288. Length and (width) of segment III and segment IV in microns: *vulgatissimus* Haliday, 68–76 (24), 64–66 (24); *meridionalis* Priesner, 76 (20), 67 (21).

[7] The only apparent differences between *vulgatissimus* and *italicus* are the slightly larger size of *italicus* and the greater number of distal bristles on the fore-vein of the fore-wing. *Vulgatissimus* is 1.2 to 1.4 mm. long and usually has three distal bristles, occasionally two or four, while *italicus* is 1.4 to 1.55 mm. long and has four to six distal bristles.

C17. Tooth comb on eighth abdominal segment absent.....C19

Tooth comb on eighth abdominal segment incomplete or slightly incomplete........ .... C21

Tooth comb on eighth abdominal segment complete....C22

Tooth comb on eighth abdominal segment not mentioned in descriptions.... . . . . C31

C18. Interocellar spines very short, only about .01 mm., placed outside of ocellar triangle; spines on posterior angles of prothorax short, outer ones .018 to .023 mm., inner .035 to .04 mm.; eight spines on posterior margin of prothorax all very small; median pair of spines on metanotum placed close to anterior margin. Body color gray brown; segment I of antennae entirely light or gray, middle segments clear at base, but occasionally the entire antennae is gray...... . . . .*discolor* (Karny), 1907[8]

Interocellar spines much longer than .01 mm.; spines on posterior angles of prothorax longer than above C19

C19. Interocellar spines .03 to .039 mm. long, placed on a line between the posterior ocelli; outer spines on posterior angles of prothorax .03 to .039 mm. long, inner spines .034 to .045 mm.; posterior margin of prothorax with six spines, occasionally eight; median spines of metanotum placed close to anterior margin; segment III of antennae shorter than IV. . .. .. *crassiconus* Moulton. 1930

Interocellar spines .045 to .05 mm. long, placed outside of ocellar triangle; outer spines on posterior angles of prothorax .048 mm. long, inner spines .056 to .06 mm.; posterior margin of prothorax with eight spines; segments III and IV of antennae equal in length.
ericae (Hal.), 1836[9]

C20. Interocellar spines rather long, about .064 mm., situated close to anterior ocellus; antennal segment VI unusually long, 66 microns, III about 49 microns, IV 44 microns; spines on posterior angles of prothorax .058 to .066 mm. long; posterior margin of prothorax with six spines. Total body length 1.3 mm......*inaequalis* (Bagn.), 1928

Interocellar spines short, not over .036 mm., situated outside of ocellar triangle, or on a line connecting anterior ocellus with the posterior pair; antennal segment VI shorter than in *inaequalis* Bagnall; spines on posterior angles of prothorax shorter than above; six or eight spines on posterior margin of prothorax.................C21

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[8] *Discolor* form *lythri* Karny differs from the regular form only through the clear yellow body color.

[9] *Erica* form *pallens* Priesner is yellowish brown or deep orange yellow, slightly colored gray, antennae dark, I and II somewhat clearer, legs yellowish gray.

C21. Segment III of antennae longer than segment IV, approximate lengths, III, 54 microns, IV 48 microns, style short, 16 to 18 mm.; posterior margin of prothorax with six spines; median pair of spines on metanotum placed behind anterior margin; comb on eighth segment sometimes only very slightly incomplete..... ...*pini* (Uzel), 1895

Segment III of antennae subequal in length to IV, approximate lengths 30 to 40 microns, style longer than in *pini*, 20 to 22 mm.; posterior margin of prothorax with eight spines; median pair of spines on metanotum placed close to anterior margin; comb on eighth abdominal segment only developed on sides. Segments I, II, VII and VIII of antennae brown, other segments yellow or at least yellow at the bases..... *frici* (Uzel), 1895 (Figs. 3, 6)[10]
(*brevicornis* (Bagn.), 1916)
(*blacki* (Watson), 1919)

C22. Interocellar spines short, not over .025 mm. long.. C23

Interocellar spines longer, at least over .025 mm.. C28

C23. Antennae dark except for segment III and often tip of II and base of IV, and sometimes base of V which are yellow........................ .. .. .C24

Antennae with yellow coloring not confined to segment III and parts of II, IV and V...... .... .C27

C24. Posterior margin of prothorax with six spines........C25

Posterior margin of prothorax with eight spines.
hawaiiensis (Morgan), 1913
(*albipes* (Bagn.), 1916)[11]
(*pallipes* (Bagn.), 1916)

C25. Antennal segments III and IV equal in length, approximately 57 microns long; antennae uniformly dark brown except segment III which is grayish brown, only a shade lighter than the other segments; spines on posterior angles of prothorax long, outer 52 to 60 microns, inner 64 to 69 microns...................*eriobotryae* Moulton, 1929

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[10] A study of female and male specimens of these three species indicates that they are synonyms. Therefore *frici* should stand as the valid specific name.

[11] *Albipes* Bagnall and *hawaiiensis* Morgan seem to be identical according to material studied, both being very similar in color, size and arrangement of spines. *Hawaiiensis* has priority and should stand as the name of the species. Available material also shows *pallipes* Bagnall to be identical with the two above species, but as there is a question about the validity of the identification, the synonym is therefore uncertain and *pallipes* will have to stand for the present.

Antennal segment III longer than IV, each shorter than 57 microns; antennae brown with III and base of IV yellowish brown; spines on posterior angles of prothorax short, only about 30 to 40 microns...... . .....C26

C26. Total body length 1 mm.; style of antennae normal, VII 5 microns long, VIII 10 microns; costa of fore wing with twenty-two spines, hind-vein with thirteen to fourteen spines... ... .*gowdeyi* (Bagn.), 1926

Larger size, total body length 1.20 to 1.36 mm.; style of antennae small with segments of equal size, each approximately 7 microns long; costa of fore-wing with thirty-two spines, hind-vein with sixteen or seventeen spines. *umtalli* Moulton, 1930

C27. Body color uniformly light yellowish-brown, apex of abdomen darker, legs yellow, much paler than body, femora shaded with brown on outer surface; antennae with segments I, III, IV yellowish and paler than others which are concolorous with or slightly darker than body, I darker than III, IV infuscate apically. Total body length 1 mm., length of antennal segment III, 45 microns, IV 36 microns, VI 42 microns..... *debilis* Hood, 1925

Body color uniformly dark brown, legs dark, only with tarsi and fore tibiae yellow; antennae with I and III yellow, distinctly lighter than II which is the darkest of entire antennae. Total body length 1.1 mm.; length of antennal segment III, 53 microns, IV 48 microns, VI 44 microns . .. *modestus* Hood, 1925

C28. Legs yellow with femora darkened with brown along outer surface; antenna with segment I grayish-brown, paler than II which is suffused with orange-red hypodermal pigmentation, III brownish yellow, darkened apically, IV to VIII dark blackish brown, nearly black, IV and V each with a pale subbasal band.. .*rufescens* Hood, 1925

Legs brown except tarsi and fore tibiae which are lighter; antennae not colored as above, brown except segment III and sometimes II at tip and IV at base which are yellowish or pale brown.... .... .C29

C29. Interocellar spines .036 to .040 mm. long... ... ...C30

Interocellar spines about .078 mm. long. Median pair of spines on metanotum placed close to anterior margin; body color dark brown, antennal segments, I, II, and V to VIII dark brown, II at tip, III and basal portion of IV yellow, wings brown, lighter at base and in the middle....................... *picipes* (Zetter), 1828

C30. Body uniformly light brown; antennae concolorous with head except segment III which is pale brown; fore-wings pale brown except basal quarter which is pale.
lemanis Treherne, 1924

Body color grayish brown to dark brown, pterothorax usually reddish brown; antennae dark brown or grayish black, segment III yellowish, sometimes weak gray above, often with II yellowish at tip and IV yellowish at base; wings clear, fore pair colored very slightly, usually at extreme tip.........*vulgatissimus* (Hal.), 1826 (Fig. 10)

C31. Antennae gray to dark brown, at most with segment III yellowish.................................C32

Antennae with yellowish color not limited to segment III. Antennae long, segment III 65, IV 54, VI 58 microns long, probably colored as in *T. italicus* Bagnall as follows: II shading from brown to yellow distally, III yellow, IV and V yellow in basal fifth or thereabouts, other segments brown (Italy)..... *sodalis* Bagnall, 1926

C32. Body color dark brown to black, legs yellowish-brown, yellow at the ends (Java)............*smithi* (Zimm.)

Body color yellowish brown......................C33

C33. Antennal segment VI as long as IV, distinctly longer than III (Java)...............*pteridicola* (Karny), 1915

Antennal segment IV distinctly the longest of the entire antennae, III, V and VI about subequal in length (Java).
mischocarpi (Zimm.)

D. Veins of fore-wing beset whole length with bristles; antennae with segment II unusually broad, segment I yellowish gray-brown, II, III, IV lighter yellowish, III lighter, V to VII gray-brown, with V yellowish at base, III somewhat longer than IV, VI as long as IV.
basicornis (Reuter), 1909

Fore-vein of fore-wing not beset whole length with bristles; antennae not as in *basicornis*.................D1

D1. Antennae dark, only segments III and IV with a pale ring near the extreme base; wings dark brown, legs dark with tibiae pale distally. Total body length 1.5 to 1.6 mm.; interocellar spines .032 mm. long, placed within ocellar triangle; length of antennal segment III, 81 microns, IV, 71 microns; length of spines on posterior angles of prothorax, inner, .05 mm., outer .038 mm.; posterior margin of prothorax with six small spines; comb on eighth abdominal segment complete; fore-vein of fore-wing with five to seven distal spines...*spiranthidis* (Bagnall), 1926

Antennae lighter in color, at least with all or part of segment III yellow.................................D2

D2. Antennae with all or part of segment III yellow, often tip of II, base of IV and V yellowish..................D3

Antennae with segment III yellow, but light coloring not limited to tip of II and bases of IV and V.........D11

D3. Segment III and IV of antennae subequal in length....D4

Segment III shorter than segment IV. Interocellar bristles about .028 mm. long, placed on a line between the two posterior ocelli; antennae dark brown, tip of II and all of III yellow, IV brown, sometimes yellowish, III 40 microns long, IV 45 microns long; outer spines on posterior angles of prothorax .048 to 52 mm.; inner spines .068 mm.; posterior margin of prothorax with six spines; comb on eighth abdominal segment absent; fore-wing with nine to eleven basal and three to six distal bristles. *firmus* Uzel, 1895

Segment III longer than IV.............. ....D6

D4. Interocellar spines short, .008 to .012 mm............ D5

Interocellar spines longer, .03 to .036 mm. Comb on eighth abdominal segment incomplete; median pair of spines on metanotum close to anterior margin; spines on posterior angles of prothorax .066 to .072 mm. long; segments III and IV of antennae 50 microns long; posterior margin of prothorax with six spines; fore-vein of fore-wing with five to seven distal bristles. .....*canavaliae* Moulton, 1929

Length of interocellar spines uncertain because of incomplete description, but with antennae dark except part of III which is more or less light, legs dark, tibiae somewhat lighter than femora, wings smoke-colored; measurements of antennae segments: III, 60 microns, IV 59 microns, V 40 microns, VI 62 microns; fore-vein of fore-wings with seven basal and seven to eleven distal bristles. *fumosa* (Trybom), 1910

D5. Posterior margin of prothorax with four spines, spines on posterior angles of prothorax about .03 mm. long; segment III of antennae 39 microns, IV 36 microns; comb on eighth abdominal segment complete but sparse; fore-vein of fore-wing with seven to nine basal and seven to nine distal bristles.. ....*pearsalli* Moulton, 1927

Posterior margin of prothorax with six spines, inner pair .024 mm., spines on posterior angles of prothorax .056 to .064 mm. long; segment III of antennae 53 microns, IV 56 microns; comb on eighth abdominal segment complete; fore-vein of fore-wing with four to nine distal bristles (usually seven or eight). (Fig. 7). *gladioli* Moulton & Steinweden, 1931

D6. Interocellar spines short.............................D7

Interocellar spines moderately long, placed outside of or on margin of ocellar triangle; tooth comb on eighth abdominal segment complete; spines on posterior angles of prothorax .086 to .1 mm. long........... .... D8

D7. Antennae dark, III brownish yellow, 60 microns long, IV 54 microns, VI 60 microns; interocellar spines placed within ocellar triangle; outer spines on prothorax .060 to .069 mm. long, inner spines .072 to .087 mm., six spines on posterior margin of prothorax; comb on eighth abdominal segment complete, but short and sparse; fore-vein of fore-wing with seven basal spines and four or five distal spines........ .. ....*abyssiniae* Moulton, 1928

Antennae dark with III, and sometimes outer part of II, gray-yellow, III 68 microns long, IV 62 microns, VI 70 microns; interocellar spines absent or very small; fore-vein of fore-wing with three basal spines and six to eleven distal spines . *meruensis* (Trybom), 1908

D8. Fore-vein of fore-wing with six to eleven distal bristles; comb on eighth abdominal segment complete; posterior margin of prothorax with six spines.... .. . .D9

Fore-vein of fore-wing with four to six distal bristles; comb on eighth abdominal segment complete D10

D9. Fore-vein of fore-wing with six to eleven distal bristles, occasionally eight or nine; antennae very thin, segment III very elongate, more than three times as long as wide; spines on posterior angles of prothorax about .086 mm. long..... ... . *annulatus* (Karny), 1907

Fore-vein of fore-wing with seven to eleven distal bristles (seldom seven or eight); antennae more stocky and shorter than in *annulatus*, segment III at most two and nine-tenths times as long as wide; spines on posterior angles of prothorax .092 to .103 mm. long.
atratus (Haliday), 1836 (Fig. 12)

D10. Fore-vein of fore-wing with four distal bristles; total body length 1.2 to 1.4 mm.; fore-wings clear; spines on posterior margin of prothorax .09 mm. long.
vulgatissimus (Hal.), 1836

Fore-vein of fore-wing with four to six distal bristles; total body length 1.4 to 1.55 mm.; fore-wings uniformly brown.
italicus Bagnall, 1926[12]

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[12] The only other apparent differences between *vulgatissimus* and *italicus* are the slightly larger size and the darker fore-wings, of *italicus*; *vulgatissimus* usually has three distal bristles on the fore-vein of the fore-wing, occasionally two or four, while *italicus* has four to six distal bristles.

D11. Interocellar spines absent. Body color brown, antennae light yellowish-gray-brown, segments I and III lighter, base and apex of III, base of IV and V white, legs lighter than body, wings yellowish-white; segments III and IV of antennae subequal in length, about 48 microns; spines on posterior angles of prothorax long, six small spines on posterior margin of prothorax; comb on eighth abdominal segment absent; fore-vein of fore-wing with seven basal and four distal bristles....... *longirostrum* (Jones), 1912

Interocellar spines present........................ D12

D12. Interocellar spines very short, only about .008 mm. long, placed within ocellar triangle. Antennae brown, segments III and IV lighter, III lighter than IV; III 39 microns long, IV 36 microns long; prothorax with spines on posterior angles equal in length, about .03 mm. and with four small spines on posterior margin; comb on eighth abdominal segment complete but sparse; fore-vein of fore-wing with seven to nine basal and seven to nine distal bristles....... ..... *pearsalli* Moulton, 1927

Interocellar spines much longer, .025 mm. or more... D13

D13. Interocellar spines .025 to .032 mm. long... .... D14

Interocellar spines longer .04 to .06 mm............. D15

D14. Interocellar bristles .028 mm. long, placed in a line between the two posterior ocelli; antennae dark brown, tip of II and all of III yellow, IV yellow; III 40 to 44 microns long, IV 44 to 48 microns long; outer spines on posterior angles of prothorax .048 to .052 mm. long, inner spines .068 mm.; eight small spines on posterior margin of prothorax; comb on eighth abdominal segment absent; fore-vein of fore-wing with nine to eleven basal and three to six distal bristles.. ... ... *firmus* (Uzel), 1895

Interocellar spines .032 mm. long; antennae with segments I, VII and VIII gray to gray-brown, II dark brown, III to V yellowish, VI yellow with distal half gray-brown; III 32 to 40 microns long, III 29 to 40 microns; outer spines on posterior angles of prothorax .044 mm., inner spines .06 mm.; eight spines on posterior margin of prothorax; comb on eighth abdominal segment incomplete; fore-vein of fore-wing with seven basal and four distal bristles.............. ......*brevicornis* (Bagn.), 1916

D15. Interocellar spines .04 to .045 mm. long; antennae uniform brown except segment I, basal part of III, base of IV which are yellowish brown; III 48 microns long, IV 45 microns long; outer spines on posterior angles of pro-

EXPLANATION OF PLATE XIX

Fig. 1.—*Taeniothrips inconsequens* Uzel, head and prothorax of female.

Fig. 2.—*Taeniothrips inconsequens* Uzel, fore tarsus of female.

Fig. 3.—*Taeniothrips frici* Uzel, head and prothorax of female.

Fig. 4.—*Taeniothrips salicus* Reuter, fore tarsus of female.

Fig. 5.—*Taeniothrips inconsequens* Uzel, posterior end of abdomen of female showing complete comb on eighth segment.

Fig. 6.—*Taeniothrips frici* Uzel, posterior end of abdomen of female showing incomplete comb on eighth segment.

Fig. 7.—*Taeniothrips gladioli* M. & S., antenna of female.

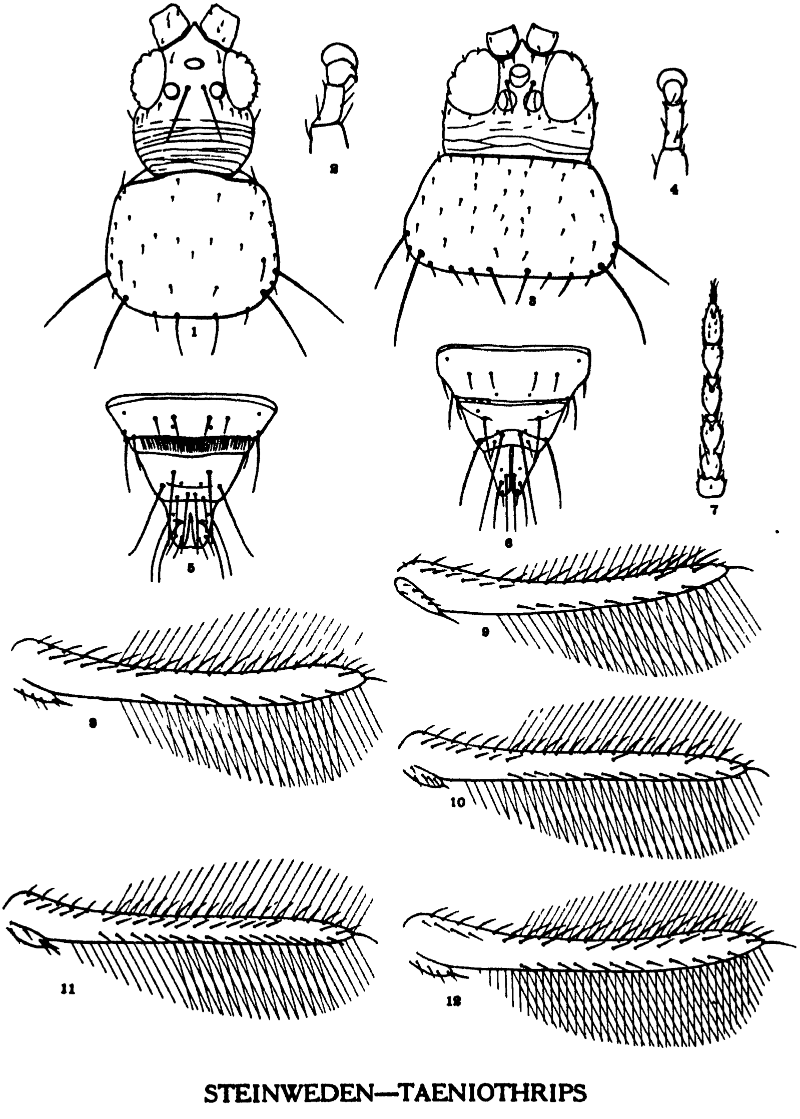
Fig. 8.—*Taeniothrips frontalis* (Uzel), fore-wing of female.

Fig. 9.—*Taeniothrips albus* (Moulton), fore-wing of female.

Fig. 10.—*Taeniothrips vulgatissimus* (Hal.), fore-wing of female.

Fig. 11.—*Taeniothrips sjostedti* Trybom, fore-wing of female.

Fig. 12.—*Taeniothrips atratus* (Hal.), fore-wing of female.



STEINWEDEN—TAENIOTHRIPS

A REVISION OF THE GENUS MEGACHILE IN THE NEARCTIC REGION[1]

PART I

CLASSIFICATION AND DESCRIPTIONS OF NEW SPECIES

(Hymenoptera: Megachilidae)

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(Plates XX and XXI)

The Genus *Megachile* is one of the largest and most widely distributed of the genera of bees. It is cosmopolitan, occurring on all of the major land areas of the earth, and is extensively distributed through all the tropical and temperate zones. Literally thousands of species have been described, while apparently many hundreds remain to be discovered, and it constitutes therefore an extensive group of closely related insects. A group of such proportions would seem to warrant the special attention of at least one taxonomist, especially as the difficulties involved in the study of such an assemblage of closely related forms are considerable. With such an objective, therefore, the species occurring in North America have been studied in considerable detail and a revision of the group as it occurs in this region has been prepared.

It was the original intention to publish a full and comprehensive account of this interesting group of bees, but circumstances have made this impossible and the somewhat less satisfactory method of publishing the data in separate parts is therefore being resorted to. This paper may be considered to be introductory in nature, its chief purpose being to present the ideas of the author concerning the classification of the Nearctic species, and to describe the numerous species previously unknown which have been discovered. This introductory paper will be followed therefore by a series of others, taking up the various groups of species in turn and presenting the data on each of the groups in more detail. These papers will contain not only a full characterization of each of the subdivisions of the genus in this region, with keys to the species included in each, but will include a consideration of certain structural features of considerable taxonomic value and much interest which have received scant attention from taxonomists in this group heretofore. These are omitted here because of lack of space and because of the fact that all of the species must be considered, both those already established and those here described as new.

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[1] Contribution from the Department of Zoology and Entomology, North Carolina State College, and published with the approval of the Director of the North Carolina Experiment Station as Paper No. 73 of the Journal Series.

Space will not permit mention of all those to whom the author is indebted for materials and suggestions which have been received. Suffice it to say that cooperation and aid has been given by many institutions and individuals throughout the United States and Canada, and to all of these the author wishes to express his appreciation for the assistance received, without which this work could not have been undertaken.

In the descriptions of species a distinction is made between structural and color characteristics, and the order of characters followed is indicative of the relative importance assigned to each. *Structure* and *puncturation* are thus emphasized, while *color,* both of the integument and pubescence is believed to be of less taxonomic value. Beyond indicating the larger group affinities of these new species, no attempt will be made here to fully discuss the closer affinities of the various species; nor will keys to the species be included, since these will be of relatively more value in the subsequent more detailed papers to be published.

The Genus *Megachile* was described by Latreille.[2] Originally it included many of the forms which now compose the Family Megachilidae. These related groups were removed one by one and erected as distinct genera, *Anthidium* by Fabricius,[3] *Stelis* and *Osmia* by Panzer,[4] *Heriades* by Spinola[5] and *Coelioxys* by

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[2] Hist. Nat. Crust. Insects, III, p. 382, (1802).

[3] Syst. Piez., p. 364, (1804).

[4] Krit. Revis., II, p. 230 and 246, (1806).

[5] Insect. Ligur., II, p. 7, (1808).

Latreille.[6] Of all the species originally included therefore, there remained but three, namely *centuncularis*, *lagopoda* and *muraria*. Of these three, Latreille selected *muraria* as the type.[6] Overlooking this original type fixation, Westwood later[7] designated *centuncularis* as the type of *Megachile*, and LePeletier[8] proposed the Genus *Chalicodoma*, to include *muraria* and several closely related Palaearctic species. Unfortunate as it may seem, therefore, *Chalicodoma* must be considered a synonym, the limited group of species in that group representing the Genus *Megachile* s. str. Moreover, neither *muraria* nor any of its close relatives occur in the Nearctic region, and the group in its more limited sense is thus unrepresented in North America.

Since 1841 there have been a number of names proposed either as genera closely allied to *Megachile* or as subdivisions of the genus in its more comprehensive sense. These are listed here (Table I) in the order of their proposal, together with the author, date, type and the region. Of the twenty-four names (other than the original) thus proposed, five are invalid, either by reason of being preoccupied or because they are synonymous with earlier names suggested. Nine of the groups concerned occur in the Nearctic Region, while the remaining ten groups, together with *Megachile* s. str. occur in other parts of the world and are not normally represented in North America.

TABLE I

MEGACHILE Latreille, 1802. Hist. Nat. Crust. Insect, iii, p. 382.
Apis muraria Retzius, (logotype).[9] Palaearctic.
Chalicodoma LePeletier, 1841. Hist. Nat. Ins , Hym., ii, p. 309.
Apis muraria Retzius, (logotype). Palaearctic.
THAUMATOSOMA Smith, 1865. Trans. Ent. Soc. London, (3), ii, p. 394.
Thaumatosoma duboulayi Smith, (haplotype).[10] Australian.
EUTRICHARAEA Thomson, 1872. Scandinav. Hym., ii, p. 228.
Apis argentata Fabricius, (haplotype). Palaearctic.
Gnathocera Provancher 1882 (nec Kirby). Le Nat Can., xiii, p. 232.
Gnathocera cephalica Provancher, (haplotype). Nearctic.

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[6] Cons. Gen. Nat. Animal, p. 336 and 439, (1810).

[7] Introd. Class. Ins., Synopsis, p. 85, (1840).

[8] Hist. Nat. Ins., Hym , ii, p. 309, (1841).

[9] Logotype. A type by subsequent designation.

[10] Haplotype. A single species included in the genus as originally described.

Paramegachile Friese, 1899. Die Bienen Europa's, Th. 5, p. 19.
Apis argentata Fabricius, (orthotype).[11] Palaearctic.

EUMEGACHILE Friese, 1899. Die Beinen Europa's, Th. 5, p. 19.
Megachile bombycina Radoszkowski, (orthotype). Palaearctic.

PSEUDOMEGACHILE Friese, 1899 Die Bienen Europa's, Th. 5, p. 19.
Megachile ericetorum LePeletier, (orthotype). Palaearctic.

CHELOSTOMOIDES Robertson, 1901. Can. Ent., XXXIII, p. 231
Megachile rufimanus Robertson, (haplotype). Nearctic.

OLIGOTROPUS Robertson, 1903. Trans. Am. Ent. Soc., XXIX, p. 168.
Oligotropus campanulae Robertson, (haplotype). Nearctic.

Ceratias Robertson, 1903 (nec. Kroy). Trans. Am. Ent. Soc., XXIX, p.168
Megachile pugnata Say, (orthotype). Nearctic.

Gnathodon Robertson, 1903. (nec. Oken) Trans. Am. Ent. Soc, XXIX, p. 168.
Megachile georgica Cresson, (haplotype). Nearctic.

XANTHOSARUS Robertson, 1903. Trans. Am. Ent. Soc, XXIX, p. 168.
Megachile latimanus Say, (haplotype). Nearctic

CYPHOPYGA Robertson, 1903. Trans. Am. Ent. Soc., XXIX, p. 169.
Megachile montivaga Cresson, (haplotype). Nearctic.

ANTHEMOIS Robertson, 1903. Trans. Am. Ent. Soc., XXIX, p. 169.
Megachile infragilis Cresson, (haplotype). Nearctic.

SAYAPIS Titus, 1905. Proc. Ent. Soc. Wash., VII, p. 154.
Megachile pugnata Say, (orthotype). Nearctic.

GRONOCERAS Cockerell, 1907. Ann Mag. Nat. Hist, (7), XX, p. 65.
Gronoceras wellmanni Cockerell, (orthotype). Ethiopian.

CREIGHTONELLA Cockerell, 1908. Entomologist, XLI, p 146.
Creightonella mitimia Cockerell, (haplotype). Ethiopian.

AMEGACHILE Friese, 1909. Die Bienen Afrika's, p 326.
Megachile nasicornis Friese. (?) Ethiopian.

ANDROGYNELLA Cockerell, 1911. Ann. Mag. Nat. Hist., (8), VII, p. 313.
Megachile detersa Cockerell, (haplotype). Australian.

BERNA Friese, 1911. Zool. Jahrb., Abt. Syst., XXX, p. 668.
Berna africana Friese, (haplotype). Ethiopian.

DELOMEGACHILE Viereck, 1916. Conn. Geol. Nat. Hist. Surv. Bull., XXII, p. 745.
Megachile vidua Smith, (haplotype), Nearctic.

SAROGASTER Roberston, 1918. Ent. News, XXIX, p. 92.
Megachile georgica Cresson, (haplotype). Nearctic.

HACKERIAPIS Cockerell, 1922. Ann. Mag. Nat. Hist., (9), X, p. 267.
Megachile rhodura Cockerell, (orthotype). Australian.

MEGACHILOIDES Mitchell, 1924. Jour. Elisha Mitchell Soc., XL, p. 154.
Megachiloides oenotherae Mitchell, (haplotype). Nearctic.

The study of a large amount of material from both North and South America, as well as a considerable amount from the

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[11] Orthotype. A type by original designation.

Palaearctic Region, has naturally led to certain conclusions concerning the classification of the species of *Megachile* in its broader sense. The multiplicity of species in the genus practically necessitates some sort of a division into groups of related forms, and so far as the North American forms are concerned, this grouping of the species has come as the natural result of the comparative studies which have been made. Thus the validity of groups previously proposed has been tested, and groups previously unrecognized have become evident, resulting in a considerable increase in the number of subdivisions of the genus in this region.

The designation of rank in classification to these groups of species is of course an expression of opinion only, and such matters of opinion often become controversial. Without desiring to side with one or the other of the opposing schools of thought in this matter, it has seemed best to designate these groups as subgenera. So far as indicating the affinities of the species is concerned, such a designation serves just as well as the assignment of a higher rank in classification would serve, and avoids some of the confusion that might result from their designation as genera. The limits of several of the groups recognized here are rather obscure, especially those groups which are represented in either the Palaearctic or Neotropical regions as well as in the Nearctic. Further studies of these groups in the adjacent regions may modify the classification as here proposed, and the merging of two subgenera would seem to be less productive of confusion than the lumping of two genera, possibly containing species having the same specific name. Moreover, the group limits in those which seem to be confined to the Nearctic Region are not necessarily sharply defined, and our knowledge of many of the species is far from complete. Sexes are very difficult to correlate in many of these groups, and consequently many of the species are known in but one sex. The discovery of the other sex in such forms may result either in the recognition of additional subdivisions of the genus or in the merging of closely related groups. Thus it seems the wisest course to call these groups subgenera, especially as they serve their purpose just as well as the higher rank would serve, possibly better, since the name of the original genus is retained and indicates the broader affinities of the species.

Of the nine groups of species in the Nearctic region which have been previously proposed, four have been retained essentially in their original sense, except that they are designated as subgenera rather than genera, and the number of species in each has been considerably augmented. These include *Xanthosarus* Robertson,[12] of which *M. latimanus* Say is the type; *Sayapis* Titus,[13] with *M. pugnata* Say the type; *Delomegachile* Viereck,[14] with *M. vidua* Smith the type; and *Megachiloides* Mitchell,[15] of which *M. oenotherae* Mitchell is the type. *Cyphopyga* and *Anthemois* Robertson,[16] have been merged under the latter name, with *M. centuncularis* Linnaeus the type, and *Chelostomoides*, *Oligotropus* and *Sarogaster*, all of Robertson, have been lumped under the name *Chelostomoides*,[17] with *M. rugifrons* Smith (*M. rufimanus* Robertson) the type. While the lines of division between these latter three groups seem to be distinct when considering the limited number of species which were studied by Robertson, the study of material from a wider area has revealed intergrading forms with the resulting obliteration of the lines of demarkation between them.

Xanthosarus, *Delomegachile* and *Anthemois* are Holarctic in distribution. In addition to the type species, *Xanthosarus* includes *M. perihirta* Cockerell, *M. dentitarsus* Sladen, *M. comata* Cresson, and *M. paratexana* Mitchell, together with two undescribed forms, from the Nearctic region, while *M. maritima* Kirby and *M. lagopoda* Linnaeus are familiar representatives from the Palaearctic region. *Delomegachile* is represented in the Palaearctic region by *M. willughbiella* Kirby, *M. nigriventris* Schenckling and possibly others, the list of Nearctic species including *M. melanophaea* Smith, *M. giliae* Cockerell, and *M. mucida*, *gemula*, *addenda* and *ingenua* of Cresson. The type species of *Anthemois*, *M. centuncularis* Linnaeus, is itself Holarctic in distribution, other Palaearctic species including *M. ligniseca* Kirby, *M. versicolor*

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[12] Trans. Am. Ent. Soc., XXIX, p. 168, (1903).

[13] Proc. Ent. Soc. Wash., VII, p. 154, (1905).

[14] Conn. Geol. Nat. Hist. Surv. Bull., XXII, p. 745, (1916).

[15] Jour. Elisha Mitchell Soc., XL. p. 154, (1924).

[16] Trans. Am. Ent. Soc., XXIX, p. 169, (1903).

[17] Can. Ent., XXXIII, p. 231, (1901).

Smith, *M. pilicrus* Morowitz, and *M. melanopyga* Costa, while it is represented in the Nearctic region by *M. relativa* Cresson, *M. montivaga* Cresson, *M. inermis* Provancher and one undescribed form.

Megachiloides is a distinctively Nearctic group which includes in addition to the type *M. amica* Cresson, *M. umatillensis* and *laurita* Mitchell, *M. anograe* Cockerell and three undescribed species.

Both *Sayapis* and *Chelostomoides* have some representation in the Neotropical region. The list of Neotropical species of *Sayapis* includes *M. zaptlana* Cresson, *M. cruziana* Mitchell, *M. howardi* Cockerell and *M. dentipes* Vachal, both of the latter two extending into the Nearctic region. Nearctic representatives of the group other than the type are *M. pollicaris* Say and *M. inimica*, *fidelis*, *frugalis* and *mellitarsis* of Cresson. *M. geophila* Cockerell is evidently the female of *mellitarsis*.

Chelostomoides is an extensive group, having a wide range, and is possibly represented in parts of the world other than those covered in this review. Neotropical species include *M. izucara*, *otomita* and *abacula* of Cresson, *M. gualanensis* and *adelphodonta* Cockerell, and *M. cartagenesis* and *haematoxylonae* Mitchell. In addition to the type and several undescribed species, the list of Nearctic species includes the following: *M. pratti*, *lobatifrons*, *davidsoni*, *angelarum*, *subexilis*, *discorhina* and *odontostoma* of Cockerell; *M. georgica* and *exilis*, Cresson; *M. occidentalis* and *longula* Fox; *M. campanulae* Robertson and *M. wilmingtoni* Mitchell.

In addition to these six subgenera previously proposed, the following ten new ones are here recognized;

LITOMEGACHILE new subgenus (See p. 308). This includes *M. brevis* Say, *M. gentilis*, *mendica* and *texana* of Cresson and *M. onobrychidis* and *coquilletti* of Cockerell. It seems to be almost entirely limited to the Nearctic region, but is apparently closely related to *Eutricharaea* Thomson[18] of the Palaearctic region.

LEPTORACHIS new subgenus (see p. 308). *M. petulans* Cresson is the sole representative in North America. It is represented in the Neotropical region, however, by thirteen or more species, as follows; *M. curta* Cresson, *M. beniensis* Cockerell, *M. squalens* Haliday, and *M. indigoferae, colombiana, emendata, aetheria, subita, numerus, immanis, inconstans, angularis* and *parata* of Mitchell.[19]

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[18] Scandinav. Hym., II, p. 228, (1872).

ARGYROPILE new subgenus (see p. 308). This includes *M. parallela* Smith, *M. townsendiana* Cockerell, and two new forms which will be described in the following pages. The group seems to be confined to the Nearctic region, but there are evidences of kinship to certain of the other subgenera which are largely Neotropical in distribution.

NEOMEGACHILE new subgenus (see p. 306). This is a Neotropical group, barely reaching the Nearctic region. It includes the following species: *M. chichimeca* Cresson, *M. coelioxoides* Cresson, *M. stomatura* Cockerell, and *M. aegra, alta* and *uniformis* of Mitchell.[20]

CRESSONIELLA new subgenus (see p. 307). This group also is Neotropical, barely reaching this region. It includes *M. zapoteka* Cresson, *M. boliviensis* Friese, *M. redondensis* Mitchell and *M. arcus* Mitchell. *M. tuxtla* Cresson has been found to be synonymous with *zapoteka.*

XEROMEGACHILE new subgenus (see p. 309). This is the largest and in some respects the most interesting of the groups occurring in this region, to which it seems to be entirely limited. It is a group of apparantly recent origin, the species being closely related, and many of them being quite specialized in structure and probably in habits. A majority of the species are new, but the following previously described species are also included: *M. integra, deflexa, subnigra, nevadensis, manifesta* and *legalis* of Cresson; *M. casadae, soledadensis, hookeri, mucorosa* and *populi* of Cockerell; and *M. dakotensis, integrella, brimleyi, wheeleri, rubi* and *pseudonigra* of Mitchell. *M. chrysothamni* Cockerell is apparantly the female of *manifesta,* and *M. spokanensis* Mitchell is the male of *wheeleri.* The female of *M. vernonensis* Cockerell is also included, but the name is invalid for reasons which will be discussed later.

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[19] Trans. Am. Ent. Soc., LVI, pp. 155–305, (1930).

[20] Trans. Am. Ent. Soc., LVI, pp. 281, 283, 284, (1930).

PHAENOSARUS new subgenus (see p. 309). This includes but two species, *M. fortis* Cresson and *M. agustini* Cockerell. The males show affinities with *Xeromegachile*, but the females would appear to be more closely related to *Xanthosarus*. For reasons which will be discussed more at length in a subsequent paper, these are believed to be related to *Xeromegachile*, and the resemblance of the females to *Xanthosarus* is considered to be due to convergence.

PSEUDOCENTRON new subgenus (see p. 307). This group centers about the Neotropical region, only two of its numerous species, (*M. pruina* Smith and *M. sidalceae* Cockerell), occurring in the Nearctic region. Other species occurring in the Neotropical region are as follows: *M. pollinosa* Spinola, *M. argentina* Friese, *M. gomphrenae* Holmberg, *M. furcata* Vachal, *M. poeyi* Guerin, *M. asuncicola* Strand, *M. limae* Schrottky, and *M. chapadiana, inscita, imperata, velhocnsis, banksi, aurata, electrum, perita* and *arabilis* Mitchell. A further study of the Neotropical fauna will probably reveal many more species of this group.

ACENTRON new subgenus (see p. 307). This group also is largely Neotropical in distribution, and is closely allied to *Pseudocentron*. It remains for the future to show whether or not the distinction between the two groups is valid. *M. albitarsis* Cresson is the sole representative in this region, other Neotropical species being *M. candida* Smith and *M. candidella, civilis* and *villarricensis* Mitchell.

MELANOSARUS new subgenus (see p. 307). *M. xylocopoides* Smith and a previously undescribed species occur in the Nearctic region. The remainder of the species are Neotropical and include *M. maura* and *sedula* Smith, *M. proserpina* Schrottky, and *M. reliqua* and *brancoensis* Mitchell. *M. vernoniae* Schrottky is apparantly the male of *prosperpina*.

In addition to their somewhat coincident distribution, there is some indication that *Leptorachis, Pseudocentron, Acentron* and *Melanosarus* are related, and that *Argyropile* is likewise a member of this group of subgenera, although differing somewhat in range. Likewise, both *Phaenosarus* and *Megachiloides* show evidences of being related to *Xeromegachile*, and as these occupy the same range, such a relationship seems reasonable. *Neomegachile* and *Cressoniella* also give some evidences of kinship, and *Sayapis* and *Chelostomoides* may possibly be related, although there is some contradictory evidence in this case. The three groups which are Holarctic in distribution, *Anthemois*, *Delomegachile* and *Xanthosarus*, are quite possibly related, the evidences being especially strong with regard to the latter two.

It will be noted that the subgenus *Eutricharea* Thomson[21] is included in the key separating the subgenera, although it has been stated that that group is Palaearctic in distribution. Apparently the nesting habits of this group are such as to make possible its wide dissemination over the earth through the channels of commerce, and species which would appear to belong to this group occur in such widely scattered areas as the West Indies, Hawaii, the Philippines, etc., and two or three specimens have been found in collections of Nearctic materials. So far as can be determined, there are none of the species established in North America at the present time, and it seems probable that the specimens found represent introduced species which failed to become established for one reason or another. It seems best therefore to include this subgenus in the key, and if additional specimens are found, they will not be confused with other groups.

Table II summarizes this data concerning the numbers of species in the various groups. The numbers of additional species in the adjacent regions does not indicate a full list of species in any case, since the fauna of these regions has not been studied thoroughly enough to be able to give a complete list in any of the subgenera. It is quite probable in fact that the number of species in most of these groups is in excess of the number given here. The Nearctic records of *Eutricharaea* are doubtful and hence are queried. With regard to *Xeromegachile*, the exact number is not possible of determination at present, since many of the species are known in but one sex. If the species are counted in but one sex, however, the number will reach at least thirty, and it is possible that the number is considerably in excess of this.

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[21] Scandinav. Hym., II, p. 228, (1872).

TABLE II

Number of Species in Nearctic Subgenera

Subgenus	Number of Nearctic species	Known Neotropical species	Known Palaearctic species
Litomegachile	6		
Eutricharaea	(2 ?)		8
Neomegachile	1	4	
Cressoniella	1	3	
Anthemois	5		4
Delomegachile	7		2
Xanthosarus	5		2
Phaenosarus	2		
Xeromegachile	30 or more		
Megachiloides	8		
Argyropile	4		
Leptorachis	1	13	
Pseudocentron	2	16	
Acentron	1	4	
Melanosarus	2	5	
Sayapis	8	2	
Chelostomoides	19	8	

GENERIC DESCRIPTION

The Genus *Megachile* may be separated from the other genera in the family by the following characters: Labrum robust, considerably longer than broad; malar space absent; maxillary palpi 3-jointed; submarginal cells subequal in length, the second receiving both recurrent nervures; pulvillus absent; and first abdominal tergite broadly excavated basally. Sexual dimorphism is very marked, as shown by the following descriptions of the two sexes:

Female.—Antennae 12-jointed, the apical joint usually longer than any of the others, but never dilated nor flattened; face, including clypeus, relatively bare of pubescence, more densely pubescent laterally and around bases of antennae; mandibles 3-, 4-, or 5-dentate, with the lower margin usually straight and simple, usually with a marginal row of rather long and stiff hairs; thorax usually densely pubsecent laterally and beneath, but only thinly so above; legs relatively unmodified, the metatarsi longer than the other joints, the hind pair quite broad and flat, often equalling their tibiae in length and breadth, the middle pair somewhat flattened; claws simple (not cleft); abdomen with six fully exposed segments, the sixth tergite narrower than the others and narrowed apically, usually more or less triangular in outline, sometimes rounded; scopa well developed on second to fifth sternites, shortened or otherwise reduced on the sixth which is usually much narrowed, rounded apically.

Male.—Antennae 13-jointed, the apical joint usually longer than the others and often modified in form; face and clypeus densly covered with long silky pubescence entirely covering the surface and hiding the apical margin of the clypeus; cheeks usually densely pubescent below, more thinly so above; mandibles 3-, or 4-dentate, the inferior margin variously modified by the presence of a conspicuous ventral protuberance, which however, is lacking in certain groups of species; pubescence of thorax usually longer and more dense than in the female, with correspondingly finer puncturation; each front coxa usually bearing a strong spine; front metatarsi sometimes simple, often much dilated, flattened, excavated and brightly colored, the more apical joints of the tarsi being successively less modified, the tarsus with a conspicuous posterior hair-fringe; mid and hind legs usually simple, the metatarsi more slender than in the female; claws deeply cleft; abdomen with seven exposed tergites and usually only four exposed sternites, the fifth to the eight sternites and the eighth tergite being entirely retracted, the morphological apex of the abdomen therefore ventral in position, the apparant apex occupied by the usually conspicuous transverse carina of the sixth tergite, the seventh tergite small, ventral in position and largely hidden from view, with only the apical margin exposed.

Key to the Nearctic Subgenera of the Genus Megachile

Antennae 13-jointed; fifth and sixth sternites entirely retracted, the exposed sternites relatively bare.. . ... Males

Antennae 12-jointed; six sternites exposed, and these with a dense brush of scopal hairs...................... .Females

Males

1. Abdomen with but three exposed sternites *Chelostomoides* Rob.
   Abdomen with four exposed sternites..................2
2. Mandibles entirely lacking an inferior projection.........3
   Mandibles with a definite inferior projection (see *petulans*, Plate XXI)......................................4
3. Small slender species, with short pubescence, the apical abdominal tergites not conspicuously tomentose, the disc of the sixth above the carina more horizontal in position *Neomegachile* n. subg.
   (Type, *M. chichimeca* Cress.)

Larger, more robust species, with long erect pubescence, the fifth and sixth tergites densely covered with pale tomentum the disc of the sixth above the carina vertical in position *Cressoniella* n. subg.
(Type, *M. zapoteka* Cress.)

4. Carina of sixth tergite usually with a definite median emargination, but this sometimes obscured by lateral denticulations 5

Carina of sixth tergite entire, at least medially, without a definite median emargination, though often denticulate or serrate (see Plate XX). 18

5. Front coxal spines vestigeal or absent . *Anthemois* Rob.

Front coxae with well developed spines. 6

6. Mid tibia lacking the usual apical spur. 7

Mid tibia with a definite apical spur 10

7. Mandibles 3-dentate; mid metatarsus conspicuously protuberant beneath. . . *Xanthosarus* Rob.

Mandibles 4-dentate; mid metatarsus not protuberant beneath 8

8. Mandible with a *median* sharp angle or tooth on the lower margin; posterior face of front femur sharply carinate above; mid tibia with a spur-like apical projection *Pseudocentron* n. subg.
(Type, *M. pruina* Smith)

Mandible without a median ventral angle; posterior face of front femur not carinate above; mid metatarsus without a spur-like apical projection, although often angulate or protuberant 9

9. Mid tibia dilated apically; front metatarsus not much produced apically, subequal in length to joints two to five combined. . . . . *Acentron* n. subg.
(Type, *M. albitarsis* Cress.)

Mid tibia not dilated apically, the inner margin with a slight angle just before the apex; front metatarsus much produced apically, its length measured along the posterior margin not much exceeding the length of the second joint (see *floridensis*, Plate XX). . . . . . . *Melanosarus* n. subg.
(Type, *M. xylocopoides* Smith)

10. Each mid coxa with a long slender spine.
Xanthosarus (*comata*)

Mid coxae not spined. 11

11. Front metatarsi dilated, usually brightly colored. 12

Front metatarsi simple, usually dark in color. 13

12. Mandibles 3-dentate; abdomen rather long and slender, parallel-sided; claws usually with sharp basal teeth. *Sayapis* Titus

 Mandibles 4-dentate; abdomen rather short and robust; claws without basal teeth. . . . . *Delomegachile* Vier.

13. Mandibles distinctly 4–dentate. 14

 Mandibles 3-dentate. 15

14. Morphological apical margin of sixth tergite (*not* its carina) with four conspicuous teeth; front coxae more or less pubescent anteriorly and without a patch of red bristles anterior to each spine. . . . . *Argyropile* n. subg. (Type, *M. parallela* Smith)

 Apical margin of sixth tergite without conspicuous teeth; front coxae bare anteriorly, with a dense patch of red bristles anterior to each spine. . . *Delomegachile* (*addenda*)

15. Morphological apical margin of sixth tergite (*not* its carina) without evident teeth; fifth tergite usually conspicuously pale tomentose 16

 Apical margin of sixth tergite with either median or lateral teeth, or with both; fifth tergite with at most rather inconspicuous pale tomentum across the base. 17

16. Carina of sixth tergite entire laterad of the definite median emargination; mandible with an indistinct tooth between the definite apical and median teeth (most species in this group have 4-dentate mandibles). *Leptorachis* n. subg. (Plate XXI) (Type, *M. petulans* Cress.)

 Carina of sixth tergite usually denticulate laterally, the median emargination inconspicuous; mandibles definitely 3-dentate. . . . . *Eutricharaea* Thom.

17. Seventh tergite produced medially into a conspicuous spine-like projection; lateral teeth of apical margin of sixth tergite conspicuous, the median teeth inevident; fifth tergite entirely lacking pale tomentum. . *Sayapis* (*frugalis*)

 Seventh tergite not conspicuously protuberant medially; apical margin of sixth with evident though small median and lateral teeth, the median pair carinate, the lateral ones acute; fifth tergite often with a narrow band of pale tomentum basally. . . . . *Litomegachile* n. subg. (Type, *M. brevis* Say)

18. Second joint of labial palpus usually somewhat longer than the first joint. . . . . *Megachiloides* Mitch.

 First and second joints of labial palpus subequal in length. . 19

19. Fourth sternite with a small but distinct median tubercle on the apical margin; large robust species with the front metatarsi broadly dilated and flattened, but only very slightly excavated anteriorly. . *Phaenosarus* n. subg.
(Type, *M. fortis* Cress.)

Fourth sternite without a median apical tubercle, usually quite broadly membraneous across the apical margin; front metatarsi dilated or not ..... *Xeromegachile* n. subg.
(Type, *M. integra* Cress.)

Females

1. Abdomen parallel-sided; narrow slender species.... ..2

Abdomen cordate or ovoid... 3

2. Mandibles with a cutting edge between the two median teeth; claws with sharp basal teeth; basal grooves of abdominal tergites not fasciate; apex of sixth tergite gradually concave; maxillary palpi neither densely nor conspicuously pubescent . . . . . *Sayapis* Titus

Mandibles lacking a definite cutting edge (see *manni* and *spinotulata*, Plate XXI); claws usually without sharp basal teeth; basal grooves of abdominal tergites often fasciate; maxillary palpi densely pubescent; sixth tergite usually abruptly concave apically, sometimes grooved just before the apex . . . .. *Chelostomoides* Rob.

3. Mandibles with five well defined teeth (see Plate XXI).. 4

Mandibles either definitely 3- or 4-dentate, or but obscurely 5-dentate.. 7

4. The two apical mandibular teeth separated from the three inner ones by a rather long cutting edge (see *floridensis*, Plate XXI); mid metatarsi equal in length to their tibiae; robust black species.. . .*Melanosarus* n. subg.

Mandibular teeth not grouped as above; mid tibiae usually somewhat longer than their metatarsi; pale-fasciate species 5

5. Abdomen more ovoid; emargination between second and third mandibular teeth fully as deep or deeper than that between the third and fourth (see *santiamensis*, Plate XXI).
Anthemois Rob.

Abdomen more cordate; emargination between the third and fourth mandibular teeth much deeper than between the second and third 6

6. Sixth tergite broad and short, broadly rounded apically, with pubescence erect nearly to the tip, the sternite not at all protruding beyond the apex of the tergite.
Xanthosarus Rob.

Sixth tergite rather long, the tip narrowly rounded or subtruncate, with pubescence appressed over apical half, the sternite protruding slightly beyond the apex of the tergite *Phaenosarus* n. subg.

7. Mandibles 3-dentate (see *gabrielensis*, Plate XXI), though sometimes with a slight angle just to the inner side of the middle tooth; second joint of labial palpus at least one and a half times the length of the first, usually much longer. *Megachiloides* Mitch.

Mandibles definitely 4-dentate; first and second joints of labial palpus subequal in length.. 8

8. Innermost mandibular tooth either rounded, or broadly and sharply truncate, never acute.. 9

Innermost mandibular tooth acute, never rounded or truncate. 11

9. Small species (9 mm. or less), with short pubescence; abdomen rather acutely pointed; pubescence of sixth tergite appressed in large part, with short suberect hairs visible toward base in profile . . .*Neomegachile* n. subg.

Larger species (12 mm. or more), with much longer and more dense pubescence; abdomen more obtuse, the sixth tergite with abundant erect pubescence visible in profile. . . 10

10. Lateral ocelli considerably nearer edge of vertex than to eyes; innermost mandibular tooth broadly truncate. *Cressoniella* n. subg.

Lateral ocelli usually nearer to eyes than to edge of vertex, but if not, the innermost mandibular tooth rounded. *Delomegachile* Vier.

11. Abdominal sternites with definite pale apical fasciae beneath the scopa... . . . .*Eutricharaea* Thom.

Abdominal sternites entirely lacking fasciae... . . . 12

12. Emargination between third and fourth mandibular teeth slightly angulate, giving an approach to the 5-dentate condition; pubescence of sixth tergite mostly or entirely appressed.... 13

Emargination between third and fourth mandibular teeth evenly concave, not at all angulate. 14

13. Abdomen more ovoid; sixth tergite distinctly concave, in profile; clypeal margin with a median incurved area. *Anthemois* (*montivaga*)

Abdomen more cordate; sixth tergite at most but very slightly concave in profile, usually straight; clypeal margin straight. . . . .*Litomegachile* (part)

14. Sixth tergite distinctly concave in profile...............15

Sixth tergite straight in profile, and nearly straight laterally in dorsal aspect..... 17

15. Sixth tergite with no erect hairs visible in profile, uniformly and entirely covered with extremely fine pale tomentum. *Argyropile* (*townsendiana*)

Sixth tergite with abundant erect pubescence visible in profile.... . . .. .16

16. Clypeal margin denticulate...... *Delomegachile* (*addenda*)

Clypeal margin entire.... ....*Litomegachile* (part)

17. Sixth sternite largely bare or but thinly pubescent, usually with a bare rim or ridge extending beyond or above the apical fringe of short hairs.. ... .18

Sixth sternite densely pubescent, without an apical bare rim or ridge............ ....*Xeromegachile* n. subg.

18. Apical rim of sixth sternite not reflexed upward orf orward .19

Apical ridge of sixth sternite reflexed upward or forward. *Argyropile* n. subg.

19. Third mandibular tooth acute, an incomplete cutting edge between it and the second tooth...*Pseudocentron* n. subg.

Third mandibular tooth truncate, without a cutting edge between the second and third teeth 20

20. Apical rim of sixth sternite very inconspicuous; cheeks narrower than eyes, and vertex very narrow behind eyes and lateral ocelli; third mandibular tooth broadly truncate. *Leptorachis* (*petulans*)

Apical rim of sixth sternite definite and rather conspicuous; cheeks below subequal in width to eyes; vertex broader back of eyes and ocelli.... . .. ..*Acentron* n. subg.

Megachile (Anthemois) santiamensis new species (Pl. XXI)

Female.—Size: Length 12 mm.; breadth of abdomen 4 mm.; anterior wing 9 mm.

Structure: Face about as long as broad; eyes subparallel; clypeal margin minutely crenulate laterally, with a median shining and slightly emarginate area; mandibles distinctly 5-dentate, an incomplete cutting edge just beyond the third tooth toward the second; basal joint of flagellum longer than the pedicel, the second and the pedicel subequal; lateral ocelli nearer edge of vertex than to eyes; vertex nearly flat; cheeks broader than eyes; mid and hind metatarsi considerably shorter and narrower than their tibiae; abdomen ovoid, the second and third tergites distinctly but not deeply grooved basally, apical margins of the third to the fifth only slightly depressed laterally, not at all medially, the sixth narrowly rounded apically, straight in profile, with suberect hairs visible only toward base.

Puncturation: Close and rather fine on cheeks, face, clypeus laterally, mesonotum laterally and anteriorly, scutellum, and on pleura above; more coarse and distinct on clypeus medially, the surface shining, and more sparse medially on supraclypeal area; deeper but rather close on vertex medially, more sparse laterally and on the mesonotum medially; rather coarse and close on pleura below; minute and indistinct on abdomen basally, becoming distinct but fine and scattered toward the fifth tergite, the more apical tergites shining, minute and densely crowded on the sixth.

Color: Black; antennae and tegulae more piceous; wings uniformly fuliginous, not much darker apically, the nervures ferruginous to piceous; spurs yellow.

Pubescence: Blackish or fuscous on vertex, cheeks above and behind eyes, and over most of mesonotum and scutellum, with a few intermixed fuscous hairs above antennae; otherwise whitish on head, thorax, legs, and on the first and second abdominal tergites; short and black on third, fourth and fifth tergites, the sixth entirely covered with brownish or fuscous tomentum and with erect black hairs near base laterally; third, fourth and fifth tergites with white apical fasciae, entire on the fifth, narrowly interrupted medially on the fourth, widely interrupted on the third; scopa ochraceous, entirely black on the fifth and sixth sternites.

Type.—Female; Santiam River, N. F., Oregon, August 27, 1914, (W. J. Chamberlain), [Oregon Agricultural College].

Paratypes.—1 ♀; Montreal, Quebec, August, [McGill Univ.]. 2 ♀; Shuswap and Peachland, British Columbia, [Can. Dept. Agr.]. 1 ♀; Banff, Alberta, [Can. Dept. Agr.]. 1 ♀ Vernon, British Columbia, August 27, 1926, [Ore. Agr. Col.]. 1 ♀; no data, [A.N.S.P.]. 1 ♀; Washington, [Mitchell]. 1 ♀; White House, Yukon Territory, August, (identified as *M. nivalis* Friese by Cockerell), [Mitchell]. 1 ♀; Calgary, Alberta, (Salt). 1 ♀; Lake Nipigon, Ontario, August 13, 1922, [Mitchell]. 1 ♀; Vancouver, British Columbia, August 15, 1916, (Sladen), [Mitchell]. 1 ♀; Fort Providence, McKenzie River, July 8, 1903, (Mer. Cary; on *Eleagnus*), [U.S.N.M.]. 1 ♀; Fort Resolution, Great Slave Lake, Canada, June 26, 1903, (Mer. Cary), [U.S.N.M.]. 1 ♀; Priest Lake, Idaho, August, [U.S.N.M.]. 1 ♀; Banff, Alberta, August 19, 1927, [Salt]. 1 ♀; Rocky

Mountains National Park, Colorado, August 22, 1926, (M. D. Farrar), [S. D. State Col.]. 1 ♀ ; Cook County, Minnesota, July 2, 1928, (Blanche Orr), [Minn. State Col.]. 1 ♀ ; Anthony Lake, Blue Mountains, Oregon, 7100 ft., August 3, 1929, (H. A. Scullen).

This species in large measure fits the description of *M. nivalis* Friese, but there are certain differences which indicate the possibility, if not the probability, that the two are not the same. *M. nivalis* is described as being white pubescent, but with *short* black pubescence on the vertex and mesonotum, the clypeus truncate, *crenulate* apically, the mandibles *4-dentate*, the scopa black on segment six (only?). The contrasting characters in *santiamensis* are as follows: *long* brownish-fuscous pubescent on vertex, mesonotum and *scutellum;* clypeus truncate, but with a median shining space on the margin which may be faintly emarginated, the margin on each side of this area very slightly crenulate, but in some specimens not at all so; mandibles definitely *5-dentate;* scopa black on both segments five and six.

Megachile (Xanthosarus) cochisiana new species (Pl. XXI)

Male.—Size: Length 12 mm.; breadth of abdomen 4 mm.; anterior wing 9 mm.

Structure: Face about as broad above as long; eyes slightly convergent below; clypeal margin with two or three minute median denticulations or crenulations; inferior margin of mandible straight between the apical tooth and the apex of the inferior projection; basal joint of flagellum subequal to pedicel, the second considerably longer, the apical one distinctly dilated and flattened; lateral ocelli subequally distant from eyes and edge of vertex, as also from each other; vertex flattened; cheeks broader than eyes; front coxal spines flattened, triangular, not much longer than broad at base, acute apically; front femur slightly keeled beneath apically; front metatarsus subequal to joints two to five in length, about equally broad basally and apically, the anterior margin slightly curved, not much produced apically, mid femur considerably swollen, the tibia relatively slender, lacking the apical spur, the metatarsus with a basal inferior narrow and somewhat curved or sinuate protuberance; hind tibia slightly curved, the metatarsus angulate medially on the anterior margin, the margin basad of this angle nearly straight, but distinctly incurved beyond the angle; mesosternum only inconspicuously carinate anterior to each mid coxa; abdomen rather broad and flat, apical margins of the third to fifth tergites rather distinctly depressed, the second depressed only toward the sides; disc of sixth tergite vertical in position, the carina short, with a small but definite median emargination, minutely and irregularly crenulate on each side; seventh tergite rather robust, broadly triangular, the tip slightly produced into a triangular point.

Puncturation: Fine and close on cheeks, vertex medially, and over entire thorax; more coarse and sparse on vertex laterally; minute and close on abdomen basally, becoming somewhat more coarse and distinct, though quite close, on the fourth and fifth tergites, very fine and close on the sixth.

Color: Black; antennae reddish-piceous beneath; mandibles ferruginous along inferior margin; tegulae yellowish; wings faintly infuscated, somewhat more deeply so apically, the nervures ferruginous to piceous; front femur dark on posterior face except near base where it is ferruginous, and ferruginous on upper face, the anterior face being more yellowish with a dark stripe along the upper and one along the lower margin; front tibia largely ferruginous, the outer face dark at extreme base, yellow at extreme apex; front tarsi yellow; mid and hind legs black, the spurs yellow.

Pubescence: Entirely pale ochraceous, with no dark intermixture evident, although the abdominal fasciae are fairly dense and conspicuous, whitish or pale ochraceous; front tarsal fringe whitish above, dark brownish beneath, and this apparant on the upper surface; mid tarsal fringe whitish, short and inconspicuous.

Type.—Male; Hereford, Cochise County, Arizona, (W. M. Mann), [U.S.N.M., no. 40570].

Paratypes.—2 ♂; topotypical. 1 ♂; Southern Arizona, [Dr. George Salt].

Although this bears a strong resemblance to *latimanus* and *perihirta,* it may be easily and at once identified by the peculiar angulate hind metatarsi.

Megachile (Xanthosarus) pallidiana new species

Female.—Size: Length 14 mm.; breadth of abdomen 5.5 mm.; anterior wing 10 mm.

Structure: Face slightly broader than long; eyes subparallel; clypeal margin straight, with one or two indefinite median crenulations; lateral ocelli subequally distant from eyes, edge of vertex, and from each other; vertex flat; cheeks broader than eyes.

Puncturation: Close and fine on cheeks, vertex medially, pleura, scutellum, and on mesonotum except anteriorly and toward the posterior middle where the punctures are more definitely separated; rather coarse and sparse on vertex laterally and on supraclypeal area; close and quite coarse on clypeus;

minute and close on abdomen basally, but becoming more distinct apically, though still very fine and close, crowded on the sixth tergite.

Color: Black; antennae piceous beneath; tegulae ferruginous posteriorly, yellowish anteriorly; wings subhyaline, faintly clouded apically, the nervures ferruginous; spurs yellow.

Pubescence: White on head except for a few short inconspicuous dark hairs on vertex laterally; white on thorax and on the first two abdominal segments, but apparantly some dark pubescence normally present in center of mesonotum, since a few scattered dark hairs may be found (specimen somewhat rubbed); more pale ochraceous on legs; dark, but short and inconspicuous, on discs of third to fifth tergites, entirely pale on the sixth where it is subappressed apically, second to the fifth with entire white apical fasciae, that on the second narrow, the others dense and quite broad; scopa entirely pale ochraceous.

Type.—Female; Albuquerque, New Mexico, August, 1894, (Snow), [Cornell University].

This is exceedingly close to *dentitarsus*, hardly differing as to color of pubescence, but it is slightly more robust and is more closely punctate, this noticeable on the clypeus, scutellum, venter of thorax, and on the abdomen. It is possibly the female of *cochisiana*, or it may be only a variant of one of the other species of *Xanthosarus*.

Megachile (Xeromegachile) victoriana new species (Pl. XX)

Male.—Size: Length 10.5 mm.; breadth of abdomen 3.5 mm.; anterior wing 7 mm.

Structure: Face about as broad above as long; eyes slightly convergent below; clypeal margin entire; mandible with middle tooth slightly emarginate and therefore approaching the 4-dentate condition, the inferior projection robust, submedian; basal joint of flagellum subequal to pedicel, the second joint longer, apical one slightly dilated and flattened; lateral ocelli subequally distant from eyes and edge of vertex; vertex nearly flat; cheeks slightly broader than eyes; coxal spines robust, pointed, slightly longer than broad at base, a rather large patch of short red bristles at base anteriorly, the coxae otherwise bare in front; front femora strongly keeled apically, polished, upper and anterior faces bare; front tarsi moderately dilated, subequal in width to the tibiae but not exceeding them, the metatarsi distinctly but shallowly excavated anteriorly and slightly produced apically (Plate XX); abdomen somewhat flattened, the third to fifth tergites quite deeply depressed apically; carina of sixth tergite (Plate XX) obtusely triangular in dorsal aspect, more rounded as seen from behind, apical margin of the tergite with carinate median teeth which are slightly nearer the vestigeal lateral teeth than to each other; seventh tergite triangularly pointed medially.

Puncturation: Close and fine on cheeks and vertex; fine on mesonotum, scutellum and pleura, and very fine on posterior face of propodeum, the mesonotum tessellate between the punctures, the scutellum more shining, the propodeum bare and shining laterally, basal triangle tessellate, rugose above; fine and close on abdomen basally, more scattered on the apical tergites, but fine and close on the sixth.

Color: Black; antennae reddish, darker above; tegulae dark reddish to piceous; wings hyaline, slightly clouded apically, the nervures brownish-yellow; front femora and tibiae largely yellowish-ferruginous, the front tarsi pale yellow; mid and hind legs entirely dark, their spurs yellow.

Pubescence: White in general, with some inconspicuous short blackish pubescence on third to fifth abdominal tergites, entirely pale on head and thorax, pale ochraceous on face; first to fifth tergites with entire white apical fasciae, the tarsal fringes white, that on the front metatarsi golden-brown beneath.

Type.—Male; Victoria, Texas, April 27, 1907, (J. D. Mitchell), [U.S.N.M. no. 44244].

Megachile (Xeromegachile) bakeri new species (Pl. XX)

Male.—Size: Length 11 mm.; breadth of abdomen 3.5 mm.; anterior wing 7.5 mm.

Structure: Face about as long as bread; eyes subparallel; clypeal margin with a deep triangular median emargination; mandible 3-dentate, the inferior projection subbasal, the tip acute and slightly curved; second joint of flagellum subequal to pedicel, the first slightly longer, the apical one considerably dilated and flattened; lateral ocelli slightly nearer eyes than to edge of vertex; vertex flat; cheeks slightly broader than eyes; coxal spines robust, flat, slightly longer than broad at base, the coxae bare anteriorly, but each with a patch of reddish bristles anterior to the base of the spine; front femur relatively slender, but rather suddenly dilated apically, the lower margin carinate; front tarsi dilated and flattened, subequal to their tibiae in width, anterior margin of the metatarsus very deeply excavated, the resulting scale slightly produced apically (Plate XX); abdominal tergites with apical margins quite deeply depressed toward the sides, only slightly so medially except on the fifth, the second to the fourth quite deeply depressed basally; carina of sixth tergite with a median triangular acute projection, irregularly crenate on either side of this, apical margin of the tergite with rather slender spine-like median teeth which are much nearer the obscure lateral angles than to each other; seventh tergite robust, produced medially into a pronounced spine.

Puncturation: Very fine and close on head and thorax throughout, densely crowded on mesonotum; minute on abdomen, close basally, becoming relatively sparse on the shining fifth tergite, fine and close on the sixth.

Color: Black; antennae and tegulae reddish-piceous; wings subhyaline, slightly clouded apically; front femur polished yellowish-ferruginous on anterior face, otherwise dark; front tibia dark on outer face except for the yellow apex, more ferruginous on the other two faces; front tarsi yellow; mid and hind legs dark, their spurs yellowish-ferruginous.

Pubescence: Long in general; white with the following exceptions: Short blackish hairs intermixed with the long white pubescence on vertex; third to sixth abdominal tergites with erect black pubescence apically, white basally; second to fifth tergites with entire white apical fasciae; tarsal fringes white, the front ones blackish beneath, those on the midtarsi very short; front metatarsal scale fringed with short dark hairs.

Type.—Male; Claremont, California, (Baker), [From collection of E. G. Titus; U.S.N.M., no. 44245.]

Megachile (Xeromegachile) palmensis new species (Pl. XX)

Male.—Size: Length 11 mm.; breadth of abdomen 4 mm.; anterior wing 8 mm.

Structure: Face considerably broader than long; eyes subparallel; clypeal margin entire, very broadly and gently incurved, almost straight; mandible 3-dentate, inferior projection subbasal, acute; basal joint of flagellum subequal to pedicel, the second slightly longer, apical one flattened and considerably dilated; lateral ocelli slightly nearer edge of vertex than to eyes; vertex slightly convex; cheeks much broader than eyes; coxal spines relatively small and quite slender, each coxa with a patch of red bristles anterior to the spine; front femur somewhat dilated apically, the lower margin carinate; front tarsi (Plate XX) dilated and flattened, but distinctly narrower than their tibiae, the metatarsus shallowly excavated on anterior margin, but not at all produced apically, equalling second to fourth joints in length; abdominal tergites relatively slightly depressed basally and apically; carina of sixth tergite triangular in outline, pointed medially, with slight irregular crenulations, the apical margin of the tergite with carinate median teeth which are much nearer the minute lateral teeth than to each other; seventh tergite robust, triangular, the apex prolonged into a spine-like projection.

Puncturation: Fine and close on cheeks and pleura; more distinctly separated and deeper, but also fine, on vertex and mesonotum; more widely separated on the shining scutellum; minute on abdomen, close basally, becoming sparse on the more apical polished tergites, but the sixth quite closely punctate.

Color: Black; antennae dark red, more piceous above; tegulae bronzy-ferruginous, with darker areas; wings hyaline, slightly clouded apically, the nervures brownish to blackish; front femur mostly ferruginous, but with dark areas on upper portions of front and hind faces; front tibia also ferruginous, but the outer face dark on basal half; front tarsi yellow, the joints with blackish spots beneath; mid and hind legs largely dark, their spurs reddish-yellow.

Pubescence: Long in general; white with the following differences: A few scattered dark hairs on vertex, a patch of dark hairs on mesonotum posteriorly, and black erect pubescence on third to fifth abdominal tergites, with a few scattered dark hairs on the second; tarsal fringes white, black beneath on the front tarsi; second to fifth abdominal tergites with entire white apical fasciae, the fourth and fifth with white tomentum basally.

Type.—Male; Palm Springs, California, March 25, 1916, (C. L. Fox), [Calif. Ac. Sc., no. 3616.]

Paratypes.—2 ♂; topotypical.

Megachile (Xeromegachile) angelica new species (Pl. XX)

Male.—Size: Length 10 mm.; breadth of abdomen 3.5 mm.; anterior wing 7 mm.

Structure: Face about as broad as long; eyes subparallel; clypeal margin smooth and shining, straight medially, but with lateral emarginations; mandible rounded in dorsal aspect, 3-dentate, the inferior projection subbasal, rather slender, the apex thickened; basal joint of flagellum subequal to second joint and also to pedicel, the apical joint flattened and broadly dilated; lateral ocelli nearer eyes than to edge of vertex; vertex nearly flat; cheeks slightly broader than eyes; coxal spines extremely broad and flat, moderately long, tips subtriangular, each coxa with a large patch of short red bristles anterior to the spine; front femora strongly keeled beneath apically; front tarsi somewhat dilated, but hardly equalling their tibiae in width, the metatarsus subequal to second to fourth joints combined, deeply excavated anteriorly, the apex not appreciably produced; abdominal tergites but very slightly depressed apically, more so basally at least on the third; carina of sixth tergite (Plate XX) with a median spine-like projection, irregularly crenulate on each side, apical margin of the tergite with carinate median teeth which are nearer the small lateral teeth than to each other; seventh tergite large and conspicuous, triangular, the apex prolonged into a spine.

Puncturation: Fine and close on head and thorax, but somewhat more distinctly separated in center of mesonotum; minute, close and indistinct on abdomen basally, becoming relatively sparse on the more apical shining tergites, relatively coarse and close on the sixth.

Color: Black; antennae red beneath; tegulae ferruginous, darker basally; wings subhyaline, slightly darker apically, the nervures piceous or dark ferruginous; legs piceous, the anterior face of front femur polished ferruginous, and also the two inner faces of the front tibia, the apex of the outer face yellow; front tarsi yellow; spurs brownish-yellow.

Pubescence: Whitish on head, thorax and basal abdominal tergites, but vertex and mesonotum with fuscous pubescence, and some short black hairs on outer faces of front and middle tibiae; second to fifth abdominal tergites with considerable long blackish pubescence, but also white in part; tarsal fringes white, the front ones blackish beneath; second to fifth tergites with broad, dense, entire, white apical fasciae.

Type.—Male; Los Angeles County, California, (Coquillett, No. 148), [U.S.N.M., no. 39971].

Paratypes.—1 ♂; San Bernardino County, California, May, (Coquillett), [Mitchell]. 2 ♂; Coronada, California, May 30, 1890, (F. E. Blaisdell), [Calif. Ac. Sc.]. 5 ♂; Keen Camp, Riverside County, California, June 6–12, 1917, (E. P. VanDuzee), [Calif. Ac. Sc.]. 1 ♂; Palm Springs, Riverside County, California, May 5, 1925, (VanDyke), [Calif. Ac. Sc.]. 2 ♂; Pagosa Springs, Colorado, June 22–24, 1919, 7200 feet, [Am. Mus. Nat. Hist.]. 2 ♂; Arrowhead, California, June 3, 1928 and May 3, 1929, (VanDyke), [Calif. Ac. Sc.]. 1 ♂; Banning, California, May 28, 1928, (VanDyke), [Calif. Ac. Sc.]. 1 ♂; Mojave, Kern County, California, June 1, 1917, (Fox), [Calif. Ac. Sc.].

Megachile (Xeromegachile) coreopsana new species

Male.—Size; Length 10 mm.; breadth of abdomen 4 mm.; anterior wing 8 mm.

Structure: Face about as broad above as long; eyes slightly converging below; clypeal margin with a pair of median tubercles; mandible 4-dentate, the inferior projection slender and basal; antennae about reaching the scutello-mesothoracic suture, the basal joint of the flagellum subequal to the pedicel, the second joint slightly longer, the apical one simple; lateral ocelli somewhat nearer eyes than to edge of vertex; vertex slightly rounded; cheeks barely as wide as the eyes, the hind margin nearly straight; thorax above narrower than head; front coxae with short triangular spines, thinly pubescent anteriorly, without evident red bristles; front femora not appreciably keeled; front tarsi simple; middle legs slender; hind femora and tibiae rather robust, the metatarsi slender and straight; abdomen short, about as broad as head, somewhat flattened, the fourth tergite slightly depressed apically, the fifth much so; carina of the sixth tergite with rounded apex, directed ventrally, apical margin of the tergite with acute median teeth which are slightly nearer the small and obscure lateral teeth than to each other; seventh tergite obscure, not protuberant medially.

Puncturation: Close and fine on cheeks and on thorax in general, but distinctly separated in center of mesonotum; numerous but well separated on vertex; minute and close on tegulae; fine and close on abdomen, but more sparse laterally, and very close and fine on the sixth tergite above, rugoso-punctate beneath the carina.

Color: Black; antennae obscurely reddish beneath; tegulae coppery, but with darker areas; wings slightly infuscated, more so apically, the nervures piceous or black; spurs yellowish.

Pubescence: Dense and pale ochraceous on face and clypeus; short and blackish on vertex, mesonotum except anteriorly, third and fourth abdominal tergites, and the second tergite apically; entirely white on cheeks (where it is dense below), pleura, scutellum, propodeum, on the first, fifth and sixth abdominal tergites, and on legs except beneath tarsi; scutello-mesothoracic suture pale-fasciate, and the second to fifth abdominal tergites with conspicuous entire white apical fasciae, these narrow medially on the second and third tergites; sternites fringed apically with white hairs; front and mid tarsi with definite and entirely white posterior fringes.

Type.—Male; Marston, North Carolina, July 4, 1928, (Mitchell; on *Coreopsis* sp.), [colln. Mitchell].

Megachile (Xeromegachile) pascoensis new species

Male.—Size: Length 9 mm.; breadth of abdomen 3 mm.; anterior wing 6.5 mm.

Structure: Face about as long as broad; eyes parallel; clypeal margin protuberant on each side of a deep triangular median emargination; mandible 3-dentate, middle tooth small, approximate to the apical one, inferior projection subbasal, the tip obliquely truncate; basal joint of flagellum slightly longer than second joint, definately longer than the pedicel, the apical one rather broadly dilated and flattened; lateral ocelli slightly nearer eyes than to edge of vertex; vertex flat; cheeks broader than eyes; front coxae bare anteriorly, the spines broad and much flattened, only slightly longer than broad at base, a patch of reddish bristles at the base of each spine; front femora slightly keeled beneath apically; front tarsi dilated, about equalling their tibiae in width, the metatarsus deeply excavated anteriorly, the tip slightly produced; hind metatarsus fully twice as long as it is broad; fifth abdominal tergite depressed apically for its entire width, the others not noticeably depressed medially, but definitely so laterally; carina of the sixth tergite with a definite triangular median protuberance, minutely crenulate on each side, apical margin of the tergite with carinate median teeth which are very close to the minute lateral teeth; seventh tergite robust, triangular, terminated by a spine-like median projection.

Puncturation: Fine and close on vertex and upper cheeks, becoming densely crowded on cheeks below; fine and close on mesonotum, pleura, and on scutellum laterally, but the latter with a median shining impunctate area; minute and crowded on abdomen basally, becoming more distinctly separated but still fine and rather close to the fifth tergite, quite close on the sixth.

Color: Black; antennae dark ferruginous beneath; tegulae reddish-piceous; wings subhyaline, slightly clouded apically, the nervures brownish-ferruginous; anterior face of front femur yellow, the other two faces largely piceous; posterior face of front tibia largely yellow, the other two faces dark ferruginous or piceous, except for the yellow apex; front tarsi yellow, the third and fourth joints with rounded dark spots beneath; spurs yellow.

Pubescence: Pale ochraceous to whitish on head, thorax, legs, and the first two abdominal tergites, with a few short dark hairs intermixed on vertex laterally; fuscous on third to sixth abdominal tergites, the second to the fifth with entire but narrow whitish apical fasciae, that on the first indistinct; front tarsal fringe white above, fuscous beneath; mid tarsal fringe short and entirely white.

Type.—Male; Pasco, Washington, May 25, 1896, [U.S.N.M., no. 39982].

Paratype.—1 ♂; Pullman, Washington, July, (W. M. Mann).

This species is very similar in many respects to *alamosana* (Plate XX). In that species, however, the length of the hind metatarsus is only about one and a half times its breadth, there is no apical fascia on the fifth tergite, and the punctures of the fifth tergite are more widely separated.

Megachile (Xeromegachile) gravita new species (Pl. XX)

Male.—Size: Length 11.5 mm.; breadth of abdomen 3.5 mm.; anterior wing 8 mm.

Structure: Face slightly longer than broad; eyes parallel; clypeal margin deeply and roundly emarginate medially, a small lateral emargination on each side; mandible strongly angled on outer margin, 3-dentate, middle tooth small, approximate to the apical one, inferior projection basal, long and robust, with an inner subapical projection visible only with mandible open, the apex obliquely truncate; basal joint of flagellum slightly longer than either the pedicel or the second joint, these subequal, the apical one very broadly dilated and flattened, its breadth nearly equalling the length; lateral ocelli much nearer eyes than to edge of vertex; vertex nearly flat; cheeks broader than eyes, each with a rounded inferior concavity, the lower margin of which is produced into a blunt densely pubescent tooth; front coxae bare and shining, each with a patch of short red bristles in front of the broad flat spine which is obliquely truncate apically, the truncation edged with fine golden pruinosity, inner margins of the spines strongly concave so that they converge, with the tips approximate; front femora not keeled beneath, relatively slender; front tarsi (Plate XX) much dilated, the metatarsus about equal to the other joints combined, deeply excavated anteriorly, this concavity with a carinate ridge extending from near the base to the apex within, the second joint short but considerably dilated; mesosternum bare and polished, with a short, sharply pointed spine in front of each middle coxa; abdomen parallel-sided, apical margins of third to fifth tergites quite distinctly depressed; carina of sixth tergite with a triangular median projection, irregularly crenulate laterally, apical margin of the tergite with carinate median teeth which are much nearer the inconspicuous lateral teeth than to each other; seventh tergite conspicuous, with a long slender median spine; first sternite somewhat produced medially, almost tuberculate.

Puncturation: Very close and fine on cheeks below, more coarse above; close and quite deep on vertex; very close and quite deep on mesonotum and scutellum, their surfaces dull; close on the more shining pleura; fine and close basally on the shining abdomen, becoming more coarse and sparse apically, the sixth tergite shining, quite deeply and rather coarsely punctate.

Color: Black; antennae more piceous beneath; tegulae yellowish-ferruginous; wings subhyaline, somewhat darker apically, the nervures ferruginous to piceous; posterior face of front femur dark, the other two faces polished and pale ferruginous, but the margin between them piceous; outer face of front tibia dark except the yellow apex, the other two faces rather dark ferruginous; front tarsi pale yellow; mid and hind spurs ferruginous to piceous.

Pubescence: Entirely whitish or pale ochraceous on head, thorax, legs, and on the first two abdominal tergites; black on the third to fifth tergites, the second to the fifth with broad entire conspicuous white apical fasciae, and the first tergite with a dense white apical tuft on each side; tarsal fringes white, the front ones brownish beneath, the middle ones short but dense.

Type.—Male; San Bernardino County, California, May, (Coquillett), [U.S.N.M., no. 39973].

Paratypes.—1 ♂ (with head missing); topotypical. 1 ♂; Los Angeles.

This bears a close superficial resemblance to *manifesta*, but the spines of the front coxae are entirely different, and the latter has no spines on the mesosternum and no red bristles on the front coxae. The seventh tergite is almost exactly alike in the two species.

Megachile (Xeromegachile) fucata new species (Pl. XX)

Male.—Size: Length 10 mm.; breadth of abdomen 3.5 mm.; anterior wing 7 mm.

Structure: Face about as broad as long; eyes subparallel; clypeal margin straight and entire; mandible 3-dentate, the inferior projection subbasal, the apex pointed and slightly recurved, thickened just above the tip; basal joint of flagellum slightly longer than pedicel, subequal to second joint, the apical one somewhat dilated and flattened; lateral ocelli slightly nearer eyes than to edge of vertex; vertex slightly convex; cheeks about as broad as eyes; front coxae bare anteriorly, with a dense patch of golden bristles in front of the rather short spines, these rounded apically and tipped with fine golden tomentum; front femora rather strongly keeled apically; front tarsi but slightly dilated, slightly narrower than their tibiae, the metatarsus slightly excavated anteriorly, not appreciably produced apically, the concavity fringed with brownish hairs; abdomen somewhat tapering posteriorly, the tergites but slightly depressed on apical margins, more so laterally and on the more apical tergites; carina of sixth tergite somewhat rounded, with two or three irregular crenulations on each side of middle, the carinate median teeth of the apical margin of the tergite nearer the small lateral teeth than to each other; seventh tergite evident, the apex produced into a rather conspicuous triangular projection.

Puncturation: Close and fine on cheeks, close on vertex medially, more scattered laterally; fine but sparse on mesonotum and scutellum medially, close laterally and anteriorly; crowded on pleura; minute and close on abdomen basally, becoming more coarse and sparse to the fifth tergite, the more apical tergites shining, the sixth shining above, but finely and quite closely punctate.

Color: Black; antennae more piceous beneath; tegulae ferruginous; wings hyaline, faintly clouded apically, the nervures ferruginous; upper face of front femur ferruginous, the posterior face darker but becoming ferruginous toward the keel, the remaining face yellowish-ferruginous with the upper margin broadly piceous; outer face of front tibia black, the anterior face ferruginous, and the remaining one yellowish-ferruginous with the outer margin black; front tarsi ivory; mid and hind legs entirely dark, their spurs yellowish.

Pubescence: White on head, thorax, legs, and on the first two abdominal tergites, the third tergite white basally, the vertex with some obscure brownish pubescence laterally just above eyes; blackish on the fifth tergite and on the fourth apically, obscurely brownish on the sixth dorsally, but white beneath the carina, the first to the fifth with dense white apical fasciae; first to third sternites with apical fringes of long white hairs; tarsal fringes white, the front ones dark brownish beneath, the edges of the metatarsal concavity fringed with short brownish hairs.

Type.—Male; Alamogordo, New Mexico, April 29, 1902, [A.N.S.P., no. 4159].

Paratype.—1 ♂; San Diego County, California, (Coquillett), [U.S.N.M.].

This is very close to *brimleyi*, but the latter differs as follows: Concavity of front metatarsus fringed with pale hairs; legs more slender; mesonotum with some black pubescence; second to fifth abdominal tergites with very short black pubsecence; seventh tergite not at all spined. Other differences will be noted if the fifth and sixth sternites are compared.

Megachile (Xeromegachile) alata new species (Pl. XX)

Male.—Size: Length 11.5 mm.; breadth of abdomen 4 mm.; anterior wing 8.5 mm.

Structure: Face slightly broader than long; eyes subparallel; clypeal margin broadly incurved medially, the edge very thin; mandible rounded in dorsal aspect, 3-dentate, the two apical teeth approximate, inferior projection subbasal, its apex flattened and rounded; antennae barely reaching tegulae, basal joint of flagellum slightly longer than pedicel, second joint subequal to the first, the apical one dilated and flattened; lateral ocelli slightly nearer eyes than to edge of vertex; vertex convex; cheeks slightly broader than eyes; front coxae bare and shining anteriorly, with a dense patch of reddish bristles anterior to the robust, short, triangularly pointed spines; front femora slightly keeled beneath apically; front tarsi slightly dilated and flattened, but distinctly narrower than their tibiae, the metatarsus parallel-sided, slightly excavated anteriorly, but not produced apically; abdomen strongly convex, second to fourth tergites depressed basally, the apical margins of the second to the fifth quite strongly depressed, more so laterally; carina of sixth tergite obtusely pointed medially, irregularly dentate on each side, apical margin of the tergite with carinate median teeth which are much closer to the small lateral teeth than to each other; seventh tergite conspicuous, produced medially into a conspicuous spine.

Puncturation: Close and fine on clypeus, vertex, cheeks and pleura; slightly more coarse and sparse on mesonotum and scutellum than on vertex, but close on mesonotum laterally; more coarse and sparse on sternum; minute and close on abdomen basally, becoming rather widely separated to the fifth tergite, but fine and quite close on the sixth, these more apical tergites shining.

Color: Black; antennae obscurely fuscous beneath; tegulae dark ferruginous; wings hyaline, slightly clouded apically, the nervures piceous; keel of front femur obscurely reddish, the upper and anterior faces yellowish-ferruginous; front tibia yellowish-ferruginous on posterior face and on apex of outer face, the anterior face piceous; front metatarsus yellowish medially, blackish along the margins, the other joints yellowish, but blackened only along the posterior margin; mid and hind legs dark except for the pale apex of the mid tibia, their spurs yellowish-ferruginous.

Pubescence: White in large part, entirely so on face, cheeks, anterior third of mesonotum, pleura, propodeum, legs and first abdominal tergite; fuscous on vertex (except hind margin), posterior two-thirds of mesonotum, and on scutellum in large part; black and rather long on second to fifth abdominal tergites, but the second white basally; scutello-mesothoracic suture white-fasciate, and second to fifth tergites with entire white apical fasciae, the more apical one conspicuous, and the sixth with a dense white apical fascia beneath the carina, the pubescence above the carina thin and largely pale; front tarsal fringes white, black beneath, the mid tarsal fringes long and entirely white.

Type.—Male; Palm Canyon, California, Apr. 3, 1925, (P. H. Timberlake), [U.S.N.M., no. 44246].

Paratypes.—1 ♂; topotypical, [Timberlake]. 1 ♂; Palm Springs, Riverside County, California, April 3, 1925, (E. C. Van Dyke), [Mitchell]. 1 ♂; Soboba Springs, Riverside County, California, May 31, 1917, (E. C. Van Dyke), [Calif. Ac. Sc].

Megachile (Xeromegachile) instita new species (Pl. XX)

Male.—Size: Length 9 mm.; breadth of abdomen 3 mm.; anterior wing 6 mm.

Structure: Face slightly longer than broad; eyes subparallel; clypeal margin subentire, with a barely discernible median notch; mandible 3-dentate, inferior projection subbasal, acute, moderately long; basal joint of flagellum very slightly longer than pedicel, slightly shorter than the second joint, apical one simple; lateral ocelli slightly nearer eyes than to edge of vertex; vertex nearly flat; cheeks subequal to eyes in width; front coxae bare anteriorly, with a small patch of reddish bristles in front of the rather short spines which are rounded apically; front femora moderately keeled apically; front metatarsi but slightly dilated, narrower than their tibiae, slightly excavated anteriorly, not at all produced apically; mid metatarsus with a long posterior fringe; abdomen parallel-sided, apical margins of the more apical tergites quite distinctly depressed; carina of sixth tergite triangularly pointed medially, apical margin of the tergite with carinate median teeth which are subequally distant from each other and the vestigeal lateral teeth; seventh tergite conspicuous, produced medially into a triangular point, but not spined.

Puncturation: Fine and shallow on cheeks; fine but well separated on vertex; fine and close on mesonotum laterally, but well separated medially; fine and sparse on scutellum; fine and rather close on pleura; minute and close on abdomen basally, becoming more coarse and less close to the fifth tergite, but very fine and close on the sixth.

Color: Black; antennae obscurely reddish beneath; tegulae ferruginous; wings slightly infuscated, darker apically, the nervures ferruginous; posterior face of front femur dark basally, more ferruginous apically, upper face ferruginous, the anterior one yellowish-ferruginous except for the broadly piceous upper margin; outer face of front tibia yellowish at apex, the other two faces ferruginous; front tarsi pale yellow, second joint with a black spot beneath; mid and hind legs entirely dark, their spurs yellowish.

Pubescence: Entirely white except for some blackish pubescence on mesonotum and on the third to fifth abdominal tergites, dense on face and cheeks below; front tarsal fringe with a few brownish hairs at base beneath, the anterior metatarsal concavity fringed with pale hairs; mid tarsal fringe entirely white; abdominal fasciae entire, white and conspicuous on all the tergites, and first to third sternites with apical fringes of rather long white hairs.

Type.—Male; Alamogordo, New Mexico, April 26, 1902, [A.N.S.P., no. 4160].

Paratypes.—2 ♂; topotypical.

Megachile (Xeromegachile) wyomingensis new species (Pl XX)

Male.—Size: Length 11 mm.; breadth of abdomen 3 mm.; anterior wing 7 mm.

Structure: Face very slightly longer than broad; eyes slightly convergent below; clypeal margin entire; mandible rounded along outer margin in dorsal aspect, 3-dentate, inferior projection basal and acute; basal joint of flagellum subequal to or very slightly longer than pedicel, the second joint slightly longer than the first, the apical one flattened and somewhat dilated; lateral ocelli slightly nearer eyes than to edge of vertex; vertex slightly convex; cheeks subequal to eyes in width; front coxae bare anteriorly, with a small patch of short red bristles in front of the rather robust spines which are rounded apically, divergent, tipped with minute tufts of golden tomentum; front femora slightly keeled beneath apically; front tarsi dilated, the metatarsus deeply excavated anteriorly, barely equalling their tibiae in width at base, but broader and slightly produced apically, nearly equalling the second to fifth joints in length; abdomen parallel-sided, fourth and fifth tergites quite deeply depressed apically; carina of the sixth tergite (Plate XX) evenly rounded, with several fine irregular denticulations medially, apical margin of the tergite with carinate median teeth which are nearer the vestigeal lateral teeth than to each other; seventh tergite conspicuous, with a short sharp median spine.

Puncturation: Fine and shallow on cheeks, close below, sparse above; fine and close, but distinct on vertex medially, more definitely separated laterally; fine and close on scutellum, pleura, and over most of mesonotum, but distinctly separated medially on the latter; fine and close on abdomen basally, becoming distinctly separated to the fifth tergite, the sixth very finely and densely punctate.

Color: Black; antennae obscurely reddish beneath; tegulae rufopiceous; wings hyaline, faintly clouded apically, the nervures pale brownish or yellow; front femur largely black, but the edge of the keel yellow, the anterior face polished yellowish-ferruginous, black along the upper margin; front tibia largely blackish, but yellow at apex, and the posterior face polished ferruginous; front tarsi yellow, with no dark areas beneath; spurs yellowish.

Pubescence: Entirely white throughout, excepting only the dark hairs on the anterior tarsal fringe beneath, and the generally yellow pubescence of the under surfaces of the mid and hind tarsi; mid tarsal fringe entirely white, longer than the anterior one; second to fifth abdominal tergites with entire white apical fasciae.

Type.—Male; Worland, Wyoming, July 5, 1917, (L. Bruner), [Un. Nebr.].

Megachile (Xeromegachile) bruneri new species (Pl. XX)

Male.—Size: Length 11 mm.; breadth of abdomen 3.5 mm.; anterior wing 8 mm.

Structure: Face about as broad as long; eyes subparallel; clypeal margin with a barely perceptible median emargination, otherwise entire; mandible 3-dentate, the inferior projection acute, located just basad of the center; basal joint of flagellum very slightly longer than pedicel, the second joint longer than the first, the apical one slightly flattened but hardly dilated; lateral ocelli slightly nearer eyes than to edge of vertex; vertex slightly convex; cheeks slightly broader than eyes; front coxae bare anteriorly, with a small patch of reddish bristles anterior to the moderately robust spines, which are flattened, rounded apically, and tipped with minute tufts of golden tomentum; front femora strongly keeled beneath apically; front metatarsi slightly narrower than their tibiae, slightly excavated anteriorly, not appreciably produced apically, about equal to second to fourth joints combined; abdomen rather broad and parallel-sided, apical margins of third to fifth tergites quite suddenly and deeply depressed, especially on the fifth; sixth tergite with a short and obscure longitudinal ridge on the upper face, the carina entire and rather broadly truncate, the median carinate teeth of the apical margin nearer the low lateral teeth than to each other; seventh tergite produced into a median spine-like projection.

Puncturation: Fine and close on cheeks, slightly separated on the shining vertex; fine and crowded over most of thorax, but slightly separated in center of mesonotum; minute and close on abdomen basally, somewhat more coarse and distinct on the third to fifth abdominal tergites, fine and close on the sixth.

Color: Black; antennae more piceous beneath; tegulae yellowish-ferruginous; wings hyaline, faintly clouded apically, the nervures ferruginous; posterior face of front femur dark, more reddish apically and along keel, the upper face ferruginous, the remaining one yellowish-ferruginous except for the more fuscous upper margin; outer face of front tibia blackish, but the apex yellow, the other two faces more ferruginous; front tarsi pale yellow, the second joint with the posterior margin beneath black; mid and hind legs dark, their spurs yellowish.

Pubescence: Entirely white, with no admixture of dark hairs, dense on face and on cheeks below, long and quite dense on thorax in general and on the first abdominal tergite; tarsal fringes white, brownish beneath on the front tarsi, the anterior metatarsal concavity fringed with ochraceous hairs; the abdominal tergites with entire white and conspicuous apical fasciae, the pubescence of the discs relatively long and thin.

Type.—Male; Fort Garland, Colorado, August 14, on *Chrysothamnus*, (L. Bruner), [Univ. Nebr.].

Paratypes.—1 ♂; Ridgeway, Colorado, July 10, about 7000 feet, [Am. Mus. Nat. Hist.]. 3 ♂; Livermore, Colorado, [Colo. Dept. Ent.]. 2 ♂; Westlake, Colorado, [Colo. Dept. Ent.].

Megachile (Xeromegachile) alamosana new species (Pl. XX)

Male.—Size: Length 11 mm.; breadth of abdomen 3.5 mm.; anterior wing 8 mm.

Structure: Face about as long as broad; eyes subparallel; clypeal margin with a rounded median emargination, and with a somewhat broader one on each side; mandible rounded on outer margin, 3-dentate, middle tooth small, approximate to the apical one, inferior projection robust, subbasal, acute, protuberant within just above the apex; basal joint of flagellum subequal to the second joint, slightly longer than pedicel, apical one very broadly dilated and flattened, its breadth subequal to the length; lateral ocelli about equally distant from eyes and edge of vertex; vertex nearly flat; cheeks broader than eyes; front coxae bare anteriorly, with a large dense patch of ferruginous bristles in front of the broad flattened triangular spines, these but slightly longer than broad at base, acute apically; front femora strongly keeled beneath apically; front metatarsi as broad at base as their tibiae, still broader apically, deeply excavated anteriorly, the resulting scale somewhat produced apically; mid metatarsi with long posterior fringes; abdomen parallel-sided, apical margins of third to fifth tergites slightly depressed; carina of sixth tergite triangularly pointed medially, with low irregular crenulations laterally, apical margin of the tergite with carinate median teeth which are much nearer the vestigeal lateral teeth than to each other; seventh tergite conspicuous, terminated by a rather long slender spine.

Puncturation: Close and fine on cheeks; slightly more coarse but close on vertex; very fine and close over most of thorax, but distinctly separated in center of mesonotum; minute and close on abdomen basally, becoming more coarse and quite sparse on the shining apical tergites, scattered on the fifth, somewhat more coarse and close on the sixth.

Color: Black; antennae more piceous beneath; tegulae dark ferruginous or piceous; wings subhyaline, faintly clouded apically, the nervures piceous to ferruginous; front femur yellowish-ferruginous where the surface is bare, with darker strips on upper margins of anterior and posterior faces; front tibia largely yellowish-ferruginous; front tarsi ivory-yellow, each joint with a rounded dark spot beneath; mid and hind legs dark, their spurs yellowish.

Pubescence: Entirely white on head, thorax, and first three abdominal tergites, dense on face and lower angle of cheeks, the front tarsal fringe white with scattered dark hairs beneath, the metatarsal concavity fringed with dark hairs on the outer margin, but with pale on the inner margin; mid tarsal fringe entirely white; second to fourth abdominal tergites with rather conspicuous entire white apical fasciae, the fourth with intermixed black and pale pubescence on the disc, the fifth not fasciate, with entirely black pubescence which is long and conspicuous, as also on the sixth above the carina.

Type.—Male; Alamosa, Colorado, June 15, 1919, about 7500 feet, [Am. Mus. Nat. Hist.].

Paratypes.—2 ♂; Colorado Springs, Colorado, June 15–30, 1896, 6000–7000 feet, (H. F. Wickham), [Am. Mus. Nat. Hist.]. 1 ♂; Newcastle, Wyoming, June, (M. Cary), [Univ. Nebr.]. 1 ♂; Bear Creek, Colorado, July 18, (E. J. Oslar), [U.S.N.M.]. 1 ♂; Colorado, [A.N.S.P.]. 1 ♂; Fort Collins, Colorado, June 16, 1900, [Colo. Dept. Ent.].

Megachile (Xeromegachile) oslari new species

Female.—Size: Length 12 mm.; breadth of abdomen 4 mm.; anterior wing 7.5 mm.

Structure: Face slightly broader than long; eyes subparallel; clypeal margin straight, subentire, shining and impunctate, with a bare indication of an irregular median tubercle; mandible 4-dentate; second joint of flagellum subequal to pedicel, the basal joint longer; lateral ocelli subequally distant from eyes and edge of vertex; vertex nearly flat; cheeks slightly broader than eyes; hind metatarsi distinctly shorter and narrower than their tibiae; abdomen cordate, apical margins of the tergites not noticeably depressed medially, but slightly depressed toward sides; sixth tergite triangular in dorsal aspect, narrowly truncate apically with the sides straight, straight in profile, with numerous short erect hairs visible.

Puncturation: Close and fine on head and thorax, except for some relatively more coarse punctures on clypeus apically where they are close, and on disc of mesonotum where they are distinctly separated at least near the center; minute and dense on abdomen basally, becoming rather sparse but still minute on the polished discs of the fourth and fifth tergites, but very fine and close on the sixth.

Color: Black; antennae beneath brownish-piceous; tegulae and spurs dark ferruginous to piceous; wings hyaline, slightly clouded apically, the nervures ferruginous.

Pubescence: Quite long and dense on head, thorax and basal abdominal tergite; white on head except for a few inconspicuous dark hairs on vertex; entirely white on upper portion of thorax, but becoming fuscous beneath, and the legs with largely fuscous pubescence; entirely black on third to sixth tergites, the second to the fifth with entire white apical fasciae; scopa entirely black.

Type.—Female; Berkely, Colorado, 6.10 (June 10?), (E. J. Oslar), [U.S.N.M., no. 44247].

Megachile (Xeromegachile) redlandica new species

Female.—Size: Length 12 mm.; breadth of abdomen 4 mm.; anterior wing 9 mm.

Structure: Face somewhat broader than long; eyes subparallel; clypeal margin entire, straight, an impressed line just above the thickened edge; mandible 4-dentate; second joint of flagellum subequal to pedicel, the first joint considerably longer; lateral ocelli subequally distant from eyes and edge of vertex; vertex nearly flat; cheeks subequal to eyes in width; hind metatarsi definitely shorter and narrower than their tibiae; abdomen cordate, the second to fourth tergites quite distinctly depressed basally, the third to the fifth slightly so apically, the sixth long and tapering, slightly concave laterally in dorsal aspect, straight in profile, with abundant erect hair visible.

Puncturation: Close and deep on clypeus; fine and indistinct on cheeks; close and fine on vertex and over most of thorax, but more coarse and well separated on mesonotum medially where the surface is very finely tessellated; close and deep on scutellum and pleura, the scutellum shining; minute and close on abdomen basally, more sparse on the shining more apical tergites, but very fine and close on the sixth.

Color: Black; antennae more piceous beneath; tegulae shining, reddish-piceous; wings hyaline, slightly clouded apically, the nervures ferruginous to fuscous; spurs yellow.

Pubescence: White on face, cheeks, pleura, propodeum, legs and basal abdominal tergites; black or fuscous on vertex, mesonotum, scutellum in part, and on discs of third to sixth tergites, as also on the second in part, the sixth with some silvery tomentum on apical third; first to fifth tergites with entire white apical fasciae, that on the first very narrow, but the others dense and conspicuous; scopa white, fuscous on sixth sternite, and a few dark hairs at extreme sides of the fifth.

Type.—Female; Redlands, California, April 14, (F. R. Cole), [U.S.N.M., no. 39980].

Megachile (Xeromegachile) hilata new species

Female.—Size: Length 12 mm.; breadth of abdomen 4 mm.; anterior wing 8.5 mm.

Structure: Face about as broad as long; eyes subparallel; clypeal margin straight and entire, impressed above the thickened and impunctate edge; mandible 4-dentate; second joint of flagellum slightly shorter than pedicel, the first joint slightly longer; lateral ocelli subequally distant from eyes and edge of vertex; vertex flat; cheeks subequal to eyes in width; hind metatarsi distinctly shorter and narrower than their tibiae; abdomen cordate, second to fourth tergites rather deeply impressed basally, apical margins of the second to the fifth quite distinctly depressed, more so toward sides, the sixth obtusely triangular in dorsal aspect, the sides straight, apex truncate, just perceptibly concave in profile, with numerous short erect hairs visible.

Puncturation: Coarse and rather close on clypeus medially, fine and dense above, and especially fine and dense on supraclypeal area; fine and close on cheeks, vertex, pleura, scutellum, and on mesonotum anteriorly and laterally, more sparse medially, the surface dull between the punctures; minute and close on abdomen basally, becoming more coarse and well separated to the fifth tergite, very fine and close on the sixth.

Color: Black; antennae obscurely reddened beneath; tegulae dark ferruginous or piceous; wings subhyaline, clouded apically, the nervures ferruginous to piceous; spurs yellowish.

Pubescence: White on face, cheeks, over most of thorax, legs and basal abdominal segment; mesonotum with some inconspicuous dark pubescence; thin and fuscous on vertex above ocelli; black and rather long on second to fifth abdominal tergites, silvery and subappressed on the sixth but with some erect black hairs across the basal half; second to fifth tergites with entire and conspicuous, white apical fasciae; scopa pale yellow, but more ferruginous on the sixth sternite where there are a few lateral black hairs.

Type.—Female; Meeker, Colorado, about 6200 feet, July 20 or 21, 1919, [Am. Mus. Nat. Hist.].

Paratypes.—2 ♀; topotypical. 1 ♀; Jim Creek, near Boulder, Colorado, about 6400 feet, July 24, 1922. 1 ♀; Livermore, Colorado, July 8, 1900, [Titus].

Megachile (Xeromegachile) impartita new species (Pl. XXI)

Female.—Size: Length 10 mm.; breadth of abdomen 3.8 mm.; anterior wing 7 mm.

Structure: Face somewhat broader than long; eyes subparallel; clypeal margin straight and entire, impressed just above the thickened shining edge; mandible 4-dentate, deeply incised between the long acute teeth; second joint of flagellum subequal to pedicel, the first joint somewhat longer; lateral ocelli subequally distant from eyes and edge of vertex; vertex nearly flat; cheeks broader than eyes; hind metatarsi only slightly narrower than their tibiae, but definitely shorter; abdomen cordate, rather flat, second and third tergites somewhat depressed basally, apical margins of the third to the fifth slightly depressed toward sides but not at all so medially; sixth tergite subtriangular with rounded apex and straight sides in dorsal aspect, straight in profile with numerous erect hairs visible.

Puncturation: Close on clypeus; fine and close on cheeks, vertex medially, and over most of thorax; well separated on scutellum and in center of mesonotum; more coarse and sparse on vertex laterally; very minute on abdomen, very close basally, becoming relatively sparse to the shining fourth and fifth tergites, close and fine on the sixth.

Color: Black; apical margin of clypeus suffused with red and mandibles largely red; antennae reddened beneath; tegulae ferruginous; wings hyaline, faintly clouded apically, the nervures ferruginous; legs dark reddish; mid and hind spurs piceous.

Pubescence: Entirely white on head, thorax, legs, and on the first two abdominal tergites; black and erect on discs of third to sixth abdominal tergites, the sixth with a small amount of silvery pubescence apically; second to fifth tergites with entire and conspicuous, white apical fasciae; scopa white, black on the fifth and sixth sternites, but with some white hairs on the fifth laterally.

Type.—Female; Colorado, [A.N.S.P., no. 4161].

Megachile (Xeromegachile) pagosiana new species

Female.—Size: Length 12 mm.; breadth of abdomen 4 mm.; anterior wing 8 mm.

Structure: Face very slightly broader than long; eyes subparallel; clypeal margin entire, impressed just above the thickened impunctate margin; mandible 4-dentate; basal joint of flagellum slightly longer than pedicel, the second joint shorter; lateral ocelli very slightly nearer edge of vertex than to eyes; vertex nearly flat; cheeks slightly broader than eyes; hind metatarsi definitely shorter and slightly narrower than their tibiae; abdomen cordate, the second and third tergites slightly depressed basally, the third to the fifth slightly so toward the sides of the apical margins but not at all medially; sixth tergite obtusely triangular in dorsal aspect, the sides nearly straight, the apex narrowly rounded, straight in profile with abundant short erect hairs visible.

Puncturation: Close on clypeus, very fine above, the supraclypeal area rugoso-punctate; fine and shallow on cheeks, close along posterior orbits; fine and close on vertex medially, more sparse laterally; fine over most of thorax, rather sparse in center of mesonotum, otherwise close, more coarse on pleura below; minute and close on abdomen basally, becoming relatively sparse on the shining more apical tergites, fine and quite close but distinct on the sixth which is also shining.

Color: Black; antennae obscurely reddish beneath; tegulae dark ferruginous; wings hyaline, faintly clouded apically, the nervures ferruginous to piceous; spurs piceous.

Pubescence: White on face, cheeks, prothorax, scutellum, pleura, propodeum and first two abdominal tergites; a considerable amount of fuscous pubescence on mesonotum, and that on vertex fuscous with intermixed long white hairs; fuscous and quite long on front coxae, short and blackish on front tibiae anteriorly; yellowish-brown beneath all the tarsi and on the outer surface of the mid metatarsus; black on discs of third to sixth abdominal tergites, that on the sixth erect and visible in profile, a small patch of silvery appressed pubescence on each extreme side; fourth and fifth tergites with entire white apical fasciae, those on the more basal tergites interrupted; scopa white, black on the fifth and sixth sternites, but with a few lateral white hairs on the fifth.

Type.—Female; Pagosa Springs, Colorado, about 7200 feet, June 22–24, 1919, [Am Mus. Nat. Hist.].

Megachile (Xeromegachile) histrata new species

Female.—Size: Length 11 mm.; breadth of abdomen 4 mm.; anterior wing 8 mm.

Structure: Face about as long as broad; eyes subparallel; clypeal margin straight, minutely crenulate; mandible 4-dentate; basal joint of flagellum very slightly longer than pedicel, the second joint slightly shorter; lateral ocelli subequally distant from eyes and edge of vertex; vertex nearly flat; cheeks slightly broader than eyes; hind metatarsi distinctly shorter and narrower than their tibiae; abdomen ovoid, second to fourth tergites slightly depressed basally, apical margins of the more apical tergites slightly depressed, more so laterally; sixth tergite very slightly concave laterally in dorsal aspect, rounded apically, straight in profile with numerous short erect hairs visible.

Puncturation: Fine and close on clypeus, supraclypeal area, cheeks along posterior orbits, and on pleura above; more coarse and sparse on cheeks posteriorly and below; fine but well separated on vertex; fine and sparse on mesonotum medially, somewhat more close on scutellum; more coarse and sparse on pleura below; minute and close on abdomen basally, becoming well separated but fine to the fifth tergite, fine and quite close on the sixth.

Color: Black; antennae obscurely piceous beneath; tegulae ferruginous; wings hyaline, faintly clouded apically, the nervures piceous; spurs yellowish.

Pubescence: White on face and cheeks, on thorax laterally and posteriorly, on legs, and on the first abdominal tergite; black on vertex, over most of mesonotum, scutellum and on second to fifth abdominal tergites where it is short, with a few long black hairs intermixed with the white between antennae; first to fifth tergites with entire white apical fasciae; sixth tergite with entirely black, short and erect pubescence, subappressed at apex; scopa white, but entirely black on fifth and sixth sternites.

Type.—Female; Alamogordo, New Mexico, April 29, 1902, [A.N.S.P., no. 4162].

Megachile (Xeromegachile) latita new species

Female.—Size: Length 12 mm.; breadth of abdomen 3.5 mm.; anterior wing 8 mm.

Structure: Face slightly broader than long; eyes subparallel; clypeal margin entire, impressed just above the polished edge; mandible 4-dentate; second joint of flagellum subequal to pedicel, the first joint longer; lateral ocelli subequally distant from eyes and edge of vertex; vertex nearly flat; cheeks subequal to eyes in width; hind metatarsi slightly narrower than their tibiae, but definitely shorter; abdomen rather ovoid, the second to fourth tergites slightly impressed basally, the more apical ones slightly depressed apically, more so toward the sides; sixth tergite slightly concave laterally in dorsal aspect, broadly rounded apically, just perceptibly concave in profile with numerous short erect hairs visible.

Puncturation: Fine and crowded on clypeus above, more coarse and sparse below, coarse and close on supraclypeal area; fine, shallow and close on cheeks; fine and close on vertex, pleura above scutellum, and on mesonotum anteriorly and laterally; more coarse on pleura below; well separated in center of mesonotum; minute and close on abdomen basally, becoming separated but still quite close on the fourth and fifth tergites, fine and close on the sixth.

Color: Black; antennae obscurely reddish beneath; tegulae dark ferruginous; wings hyaline, faintly clouded apically, the nervures ferruginous; spurs yellowish-brown.

Pubescence: White on face, cheeks, thorax, and on the first two abdominal tergites; short, dark and thin on vertex; black on third to fifth abdominal tergites; silvery and subappressed on the sixth tergite, where there are a few erect black hairs across the base; scutello-mesothoracic suture with an obscure white fascia; first to fifth tergites with entire and conspicuous white apical fasciae; scopa white on second to fourth sternites, black on the fifth and sixth.

Type.—Female; Worland, Wyoming, July, 1911, (L. Bruner), [Univ. Nebr.].

Paratype.—1 ♀; Maybell, Colorado, August 1, 1904, [Colo. Dept. Ent.].

Megachile (Xeromegachile) blaisdelli new species

Female.—Size: Length 11 mm.; breadth of abdomen 4.5 mm.; anterior wing 8 mm.

Structure: Face about as broad as long; eyes subparallel; clypeal margin entire, thickened and shining, impressed just above the edge; mandible 4-dentate; second joint of flagellum subequal to pedicel, the first joint longer; lateral ocelli subequally distant from eyes and edge of vertex; vertex flat; hind metatarsi nearly equalling their tibiae in width, but distinctly shorter; abdomen cordate, the tergites but slightly depresseed apically, more so basally on the second to fourth; sixth tergite very slightly concave laterally in dorsal aspect, straight in profile with abundant erect hair visible.

Puncturation: Fine and close on cheeks behind eyes, on vertex medially, scutellum, and on pleura above, becoming more coarse and sparse below; close on supraclypeal area and on clypeus laterally and above, more coarse and distinct on clypeus below; more sparse and coarse on cheeks posteriorly, and more sparse on vertex laterally; small but distinctly separated medially on the shining mesonotum; very fine on abdomen, close basally, but rather sparse on the shining fourth and fifth tergites, fine and close on the fifth.

Color: Black; antennae fuscous beneath; tegulae ferruginous to piceous; wings faintly infuscated, more so apically, the nervures piceous, stigma more ferruginous; mid and hind spurs fuscous.

Pubescence: Black on clypeus, cheeks, vertex, mesonotum, pleura, lateral faces of propodeum, legs, and discs of second to sixth abdominal tergites, with no admixture of pale hairs on the sixth; white on face laterally and between antennae, on prothorax above, around margin of mesonotum, with dense patches in front of and behind each wing base, on posterior face of propodeum, and on the first abdominal tergite; scutellum with intermixed long white and short black hairs; somewhat silvery on outer face on mid metatarsus; second to fifth tergites with entire and conspicuous white apical fasciae; scopa entirely black.

Type.—Female; Coronado, California, June 2, 1890, (F. E. Blaisdell), [Calif. Ac. Sc., no. 3617].

Paratypes.—2 ♀; topotypical, May 30 and June [Calif. Ac. Sc.]. 2 ♀; San Diego, California, June 5, 1891, (Blaisdell), [Calif. Ac. Sc.]. 1 ♀; Warner Mountains, Lake County, Oregon, June 19, 1922, (E. C. Van Dyke), [Calif. Ac. Sc.]. 1 ♀; Poway, San Diego County, California, June 8, 1885, (Blaisdell), [Calif. Ac. Sc.]. 1 ♀; Bear Valley, Santa Cruz Mountains, California, August 1913, (F. C. Clark), [Calif. Ac. Sc.]. 1 ♀; Puente (?) Hills, California, May 8, 1927, on *Eucelia californica*, (P. H. Timberlake). 3 ♀; Riverside, California, April and May, on *Eucelia farinosa*, cultivated *Coreopsis* and *Chaenactis glabriuscula*, (P. H. Timberlake). 11 ♀; Ashland, Oregon (12–15 miles east), Dead Indian Road, 4500–4900 feet, July 17, 1930, (H. A. Scullen), [Ore. Agr. Col.].

Megachile (Xeromegachile) smithi new species

Female.—Size: Length 12.5 mm.; breadth of abdomen 4 mm.; anterior wing 9 mm.

Structure: Face about as long as broad; eyes subparallel; clypeal margin straight and entire, lacking a definitely demarked rim; mandible 4-dentate; second joint of flagellum slightly shorter than the pedicel, the first slightly longer; lateral ocelli much nearer edge of vertex than to eyes; vertex flat; cheeks subequal to eyes in width; hind metatarsi distinctly shorter and slightly narrower than their tibiae; abdomen cordate, the tergites depressed only slightly on apical margins medially, but more so laterally; sixth tergite straight laterally in dorsal aspect, subtruncate apically, straight in profile with numerous short erect hairs visible.

Puncturation: Close and fine on cheeks, pleura above, and mesonotum anteriorly; more distinctly separated but close on vertex; relatively widely separated in center of mesonotum and on scutellum; very minute and widely scattered on the polished clypeus; densely crowded and minute on abdomen basally, becoming more coarse and more distinctly separated to the fifth tergite, but very fine and close on the sixth.

Color: Black; antennae obscurely reddish beneath; tegulae dark ferruginous; wings subhyaline, faintly clouded apically, the nervures fuscous to black; spurs pale ferruginous.

Pubescence: White on face, cheeks, pleura, propodeum, legs and first abdominal tergite; fuscous on vertex, mesonotum and scutellum; short and blackish on third to sixth abdominal tergites, the second with a small amount of black in the generally white pubescence, the sixth with a small amount of white tomentum apically; first to fifth tergites with entire, creamy-white apical fasciae, that on the first narrow, but broad and dense on all the others; scopa white, black on the sixth sternite, and a few apical black hairs on the fifth; tarsal fringes of front and mid metatarsi exceptionally long, longer than in most males.

Type.—Female; Palm Springs Canyon, California, March 9, 1924, (H. S. Smith), [received from P. H. Timberlake; U. S. N. M., no. 44248].

Paratype.—1 ♀; Palm Springs, California, March 21, 1916, (C. L. Fox), [Calif. Ac. Sc.].

This is very close to *M. populi* Cockerell, but differs in the more deeply incurved hind margin of the vertex, the lateral ocelli being consequently much nearer the edge of the vertex than in *populi*, with the pubescence of the mesonotum and scutellum in large part black, the mid tarsal fringes almost as long as the front ones, and the sixth tergite with much erect black pubescence and relatively little pale tomentum. In *populi* there is relatively little dark pubescence on the dorsum of the thorax, the mid tarsal fringe is much shorter than that of the front tarsus, and the sixth tergite has little dark pubescence and much pale tomentum.

Megachile (Xeromegachile) moschata new species

Female.—Size: Length 11 mm.; breadth of abdomen 4 mm.; anterior wings 7.5 mm.

Structure: Face slightly broader than long; eyes subparallel; clypeal margin straight and entire, impressed just above the shining edge; mandible 4-dentate; second joint of flagellum subequal to pedicel, the basal joint slightly longer; lateral ocelli subequally distant from eyes and edge of vertex; vertex flat;

cheeks subequal in width to eyes; hind metatarsi distinctly shorter and narrower than their tibiae; abdomen cordate, the tergites but slightly depressed apically; the sixth subtriangular in dorsal aspect, more broadly rounded apically, straight in profile with abundant erect hair visible.

Puncturation: Fine and close on cheeks, vertex medially, pleura and scutellum; somewhat more coarse and deep on clypeus, vertex laterally, and mesonotum, close on the clypeus and on mesonotum except medially where the punctures are relatively widely separated and the surface shining, slightly closer than this on the vertex; minute and close on abdomen basally, becoming somewhat more coarse but yet quite close on the more apical tergites, but fine and close on the sixth.

Color: Black; antennae, tegulae, wing nervures and spurs piceous; wings subhyaline, slightly clouded apically.

Pubescence: White on face, cheeks, pleura, propodeum, and basal abdominal tergite; blackish and rather long on vertex, over most of mesonotum, and on third to sixth abdominal tergites, largely white on the second tergite, but with black hairs evident laterally; black in center of scutellum, but this margined with long white hairs; second to fifth tergites with entire conspicuous white apical fasciae, and an indistinct one on the first tergite; sixth tergite with a very slight amount of pale tomentum at extreme tip; largely white on legs, but somewhat yellowish on tibiae and tarsi; scopa white, black on fifth and sixth sternites.

Type.—Female; Riverside, California, May 3, 1928, on garden *Coreopsis*, (P. H. Timberlake), [U. S. N. M., no. 44249].

Paratypes.—3 ♀; Riverside, May 7 and 14, 1928, on *Coreopsis*, and April 28, 1928.

This has been given the name *moschata* at the suggestion of Professor Timberlake, who states that the specimens when caught "gave out a very strong fetid musky odor when fresh, presumably comparable but much stronger than the odor given off by a box of fresh bumble bees." He further suggests that the odor may be connected with the metabolism of nesting females.

This species is very close to *pagosiana* and *mojavensis*, but may be distinguished from both by the presence of dark hairs on the scutellum. In addition to this, the punctures on the abdomen are deeper and more distinct, as well as more close, especially on the third tergite, these being minute on that tergite in the other two species.

Megachile (Xeromegachile) mojavensis new species

Female.—Size: Length 11 mm.; breadth of abdomen 3.5 mm.; anterior wing 7 mm.

Structure: Face about as broad as long; eyes subparallel; clypeal margin straight, the median portion thickened and shining, impressed just above the edge; mandible 4-dentate; second joint of flagellum subequal to pedicel, the basal joint slightly longer; lateral ocelli subequally distant from eyes and edge of vertex; vertex slightly convex; cheeks subequal to eyes in width; hind metatarsi distinctly shorter and narrower than their tibiae; abdomen cordate, the tergites but very slightly depressed apically; sixth tergite triangular in dorsal aspect, the sides straight and tip narrowly rounded, straight in profile with abundant erect hair visible.

Puncturation: Close and fine on upper part of face, vertex medially, cheeks, pleura above and scutellum; somewhat more coarse and more distinctly separated on clypeus below, vertex laterally and mesonotum medially, but close on the mesonotum around the margin; minute and crowded on basal abdominal tergites, becoming quite sparse but still fine on the polished more apical tergites, but very fine and close on the sixth; tegulae shining, almost impunctate medially.

Color: Black; antennae, tegulae, wing nervures and spurs dark piceous-red; wings subhyaline, slightly clouded apically.

Pubescence: White on head and thorax except for some long dark hairs on vertex and shorter dark hairs covering most of mesonotum; white on legs, but becoming slightly yellowish on tibiae and tarsi; entirely white on the first two abdominal tergites, the third to sixth with erect black pubescence, the sixth without pale tomentum; second to fifth tergites with entire white apical fasciae, the first with an indefinite one; scopa white, entirely black on the fifth and sixth sternites.

Type.—Female; Mojave, Kern County, California, June 1, 1917, (C. L. Fox), [Calif. Ac. Sc. no. 3618].

Paratype.—1 ♀; Palm Springs, California, March 22, 1916, (C. L. Fox).

Megachile (Xeromegachile) bradleyi new species

Female.—Size: Length 14 mm.; breadth of abdomen 5 mm.; anterior wing 10 mm.

Structure: Face slightly broader than long; eyes subparallel; clypeal margin straight, with an impressed line just above the shining edge; mandible 4-dentate; second joint of flagellum subequal to pedicel, the basal joint longer; lateral ocelli subequally distant from eyes and edge of vertex; vertex flat; cheeks subequal to eyes in width; hind metatarsi distinctly shorter and narrower than their tibiae; abdomen broadly cordate, the tergites not conspicuously depressed apically, but the third and fourth rather deeply depressed or grooved basally; sixth tergite subtriangular in dorsal aspect, the sides nearly straight and the apex rounded, very nearly straight in profile with abundant erect hair visible.

Puncturation: Fine and close on cheeks, vertex medially, pleura and scutellum; slightly more coarse and more distinctly separated on vertex laterally; quite coarse on mesonotum, close except in center; minute and crowded on clypeus and on abdomen basally, becoming more distinct and deeper, but still close and fine to the fifth tergite, very close and fine on the sixth.

Color: Black; antennae more piceous; tegulae dark ferruginous or piceous, with yellowish blotches; wings subhyaline, slightly clouded apically, the nervures brownish to piceous; mid and hind spurs yellowish.

Pubescence: White on head and thorax except for scattered fuscous hairs on vertex laterally and in center of mesonotum; entirely white on first to fourth abdominal tergites, the fifth and sixth with conspicuous erect black hairs, the sixth with silvery tomentum which is more dense apically; first to fifth tergites with broad dense entire white apical fasciae; pubescence white on legs, but becoming more yellowish on the tibiae and tarsi; scopa white, black on the sixth sternite.

Type.—Female; Las Vegas, Nevada, September 17, 1908, (J. C. Bradley), [Cornell University].

Paratype.—1 ♀ ; topotypical.

Megachile (Xeromegachile) toscata new species

Female.—Size: Length 12 mm.; breadth of abdomen 4 mm.; anterior wing 7.5 mm.

Structure: Face slightly broader than long; eyes subparallel; clypeal margin straight and entire, the edge polished and with a few large scattered punctures; mandible 4-dentate; basal joint of flagellum slightly longer than pedicel (all other joints missing); lateral ocelli subequally distant from eyes and edge of vertex; vertex flat; cheeks slightly broader than eyes; hind metatarsi distinctly shorter and narrower than their tibiae; abdomen cordate, the tergites depressed basally only toward the sides, the second and third more deeply so, the apical margins quite distinctly depressed toward the sides, but not medially; sixth tergite obtusely triangular in dorsal aspect, the sides slightly concave and the apex subtruncate, straight in profile with numerous short erect hairs visible.

Puncturation: Close and fine on cheeks, vertex medially, clypeus and entire thorax; more coarse and widely separated on vertex laterally; minute and densely crowded on abdomen basally, becoming more coarse and distinct, but quite close, to the fifth tergite, very close and fine on the sixth.

Color: Black; tegulae rather dark ferruginous; wings subhyaline, faintly clouded apically, the nervures ferruginous; spurs yellowish.

Pubescence: White on face and cheeks, on first two abdominal tergites, and on thorax except mesonotum; vertex and mesonotum with considerable fuscous pubescence; white on basal leg joints, more or less yellowish on the more apical joints; third to sixth abdominal tergites with short black pubescence, the first to the fifth with entire white apical fasciae, and the sixth with silvery tomentum apically; scopa almost entirely white, dark only at extreme apex of sixth sternite.

Type.—Female; Fort Collins, Colorado, September 7, 1903, [Colorado State Entomologist].

Megachile (Xeromegachile) seducta new species

Female.—Size: Length 12 mm.; breadth of abdomen 4 mm.; anterior wing 8 mm.

Structure: Face slightly broader above than long; eyes subparallel; clypeal margin straight and entire, an impressed line just above the polished and impunctate edge; mandible 4-dentate; second joint of flagellum subequal to pedicel, the basal joint slightly longer; lateral ocelli subequally distant from eyes and edge of vertex; vertex very nearly flat; cheeks subequal to eyes in width; hind metatarsi almost equalling their tibiae in width, but definitely shorter; abdomen more ovoid than cordate, the tergites but slightly depressed apically except toward the sides, and only slightly depressed basally; sixth tergite subtriangular in dorsal aspect, the sides straight and tip rounded, straight in profile with abundant short erect hairs visible.

Puncturation: Fine and close on cheeks, vertex, and over most of mesonotum, more shallow on cheeks, slightly more coarse and separated to some slight degree in center of mesonotum, close and distinct, but not crowded on scutellum; close and rather coarse on clypeus, especially below; minute and crowded on abdomen basally, becoming more distinct and relatively sparse to the fifth tergite, the more apical tergites shining, very close and fine on the sixth.

Color: Black; antennae reddish-piceous beneath; tegulae dark ferruginous; wings subhyaline, slightly clouded apically, the nervures piceous; mid and hind spurs piceous.

Pubescence: White on face, cheeks, pleura, propodeum, legs and basal abdominal tergite; dark and quite long on vertex and mesonotum, the scutellum with intermixed light and dark hairs; black and relatively short on second to sixth tergites, that on the second slightly intermixed with white, the sixth with no trace of pale tomentum; second to fifth tergites with entire white apical fasciae; scopa white, entirely black on the fifth and sixth sternites.

Type.—Female; Keen Camp, Riverside County, California, June 6–12, 1917, (E. P. Van Duzee), [Calif. Ac. Sc. no. 3619].

Megachile (Xeromegachile) dulciana new species

Female.—Size: Length 12 mm.; breadth of abdomen 4 mm.; anterior wing 8 mm.

Structure: Face very slightly broader than long; eyes subparallel; clypeal margin straight and entire, with a row of deep impressions just above the edge; mandible 4-dentate; second joint of flagellum subequal to pedicel, the first joint slightly longer; lateral ocelli considerably nearer edge of vertex than to eyes; vertex flat; cheeks slightly broader than eyes; hind metatarsi distinctly shorter and narrower than their tibiae; abdomen more or less ovoid, apical margins of the tergites rather deeply depressed toward the sides, but only slightly so medially, the basal depression of the third rather deep; sixth tergite subtriangular in dorsal aspect, with straight sides and rounded apex, straight in profile with short erect hairs visible.

Puncturation: Extremely fine and close on cheeks and considerably so on vertex; clypeus polished and nearly impunctate, with only widely scattered indistinct punctures; close and fine on pleura, but more coarse than on cheeks; relatively fine and sparse in center of mesonotum and scutellum, becoming more close around the margins; very fine and densely crowded on abdomen basally, becoming slightly more coarse and sparse, though relatively close, to the fifth tergite, very fine and densely crowded on the sixth.

Color: Black; flagellum of antenna, tegulae, wing nervures in large part, and spurs ferruginous; wings subhyaline, faintly clouded apically.

Pubescence: White on face, cheeks, thorax except mesonotum, legs and first two abdominal tergites; more or less fuscous on vertex and mesonotum, with a few dark hairs on scutellum; blackish on fourth and fifth abdominal tergites, and black in part on the third where it is white across the base, the sixth with much silvery tomentum and erect pale hairs, with only a few inconspicuous black hairs toward the base; second to fifth tergites with entire white apical fasciae; front and mid metatarsi with rather long white posterior hair fringes, but these not equalling the metatarsi in length; scopa yellowish-white, dark only at extreme tip of sixth sternite.

Type.—Female; San Diego County, California, April, (Coquillett), [U. S. N. M. no. 44250].

This species is very close to *M. populi* Cockerell, differing chiefly in the nearness of the lateral ocelli to the edge of the vertex. Moreover, in *populi* the mid tarsal fringes are considerably shorter, the antennae and tegulae are much darker, more piceous than ferruginous, and the dark pubescence of vertex and mesonotum is more restricted, shorter, and consequently much less conspicuous.

Megachile (Megachiloides) subanograe new species

Female.—Size: Length 9 mm.; breadth of abdomen 3 mm.; anterior wing 6.5 mm.

Structure: Face about as long as broad; eyes subparallel; clypeal margin nearly straight, thickened and somewhat pitted medially; mandible 3-dentate, the two apical teeth approximate; second joint of flagellum subequal to pedicel, the basal joint slightly longer; lateral ocelli subequally distant from eyes and edge of vertex; vertex nearly flat; cheeks slightly broader than eyes; hind metatarsi distinctly shorter and narrower than their tibiae; abdomen ovoid, the tergites but very slightly depressed basally and apically; sixth tergite triangular in dorsal aspect, narrowly subtruncate apically with the sides straight, straight in profile with abundant erect hair visible.

Puncturation: Fine and close on face, clypeus above, vertex medially, and scutellum; becoming more coarse on clypeus below, more coarse and sparse on cheeks below and vertex laterally; sparse in center of the shining mesonotum, but closer around the margin; relatively coarse, deep and sparse on pleura; minute and close on first two abdominal tergites, becoming increasingly sparse but also fine to the fifth tergite, somewhat less sparse on the sixth, all of the tergites shining.

Color: Black; antennae dark ferruginous beneath; tegulae yellowish-ferruginous; wings hyaline, very slightly clouded apically, the nervures brownish-ferruginous; hind spurs fuscous, the front and middle ones yellowish or brownish.

Pubescence: Entirely white on head, thorax, legs and first to fourth abdominal tergites, the fifth and sixth with sparing black pubescence; first to fifth tergites with white apical fasciae, dense on the more apical tergites, obscure on the more basal ones; scopa white, entirely black on the fifth and sixth sternites.

Type.—Female; Green River, (about 41° 32′ N., 109° 28′ W.) 6100 feet altitude, Wyoming, July 2, 1920, [Am. Mus. Nat. Hist.].

Megachile (Megachiloides) astata new species

Female.—Size: Length 11 mm.; breadth of abdomen 3.5 mm.; anterior wing 7.5 mm.

Structure: Face very slightly longer than broad; eyes subparallel; clypeal margin straight, the rim thickened, with shallow pits medially; mandible 3-dentate, the middle tooth very small and very close to the apical one; second joint of labial palpus slightly less than twice the length of the first; second joint of flagellum slightly shorter, the basal joint longer, than the pedicel; lateral ocelli slightly nearer eyes than to edge of vertex; vertex flat; cheeks slightly broader than eyes; hind metatarsi considerably narrower and shorter than their tibiae; abdomen cordate, the tergites but very slightly depressed basally or apically; sixth tergite subtriangular in dorsal aspect, the apex subtruncate and the sides straight, nearly straight in profile, being slightly concave toward the apex, with abundant erect hair visible.

Puncturation: Fine and close on face, vertex, cheeks above, mesonotum scutellum and pleura above; becoming rather coarse and sparse on cheeks and pleura below; rather coarse but close on clypeus; minute and close on abdomen basally, becoming rather widely separated and relatively coarse to the apical tergites, the surfaces of these shining, more so on the more apical tergites.

Color: Black; antennae and tegulae dull ferruginous; wings subhyaline, slightly clouded apically, the nervures brownish-ferruginous; spurs piceous.

Pubescence: Pale ochraceous above fading to white below on head and thorax, but mesonotum with a small patch of fuscous pubescence, and a slight amount of the same color on the vertex; pale ochraceous and relatively long on basal abdominal tergites, shorter on the following tergites, black on the third to the sixth, with only very inconspicuous dark hairs on the second, the sixth entirely lacking pale tomentum; second to fifth tergites with dense though narrow entire pale ochraceous apical fasciae, a less conspicuous one on the first; scopa white, entirely black on the fifth and sixth sternites.

Type.—Female; San Bernardino County, California, May, (Coquillett), [U. S. N. M., no. 39972].

Paratypes.—1 ♀; Olympia, Washington, August 20, 1893, (T. Kincaid), [Mitchell]. 1 ♀; Washington, [Cornell Univ.]. 1 ♀; Twin Rocks, Mendocino County, California, July 10, 1929, (E. C.

Van Dyke), [Calif. Ac. Sc.]. 1 ♀; Yosemite Valley, California, June 4, 1926, (P. H. Timberlake).

The paratypes listed differ slightly from the type specimen in color and pubescence, the antennae, tegulae and wing nervures being darker, and the pubescence whiter, with the dark areas of the vertex and mesonotum more definitely black.

Megachile (Megachiloides) gabrielensis new species (Pl. XXI)

Female.—Size: Length 11 mm.; breadth of abdomen 3.5 mm.; anterior wing 7.5 mm.

Structure: Face about as broad as long; eyes subparallel; clypeal margin rather broadly outcurved, with some irregular median impressions or indentations; mandible 3-dentate, the middle tooth small, approximate to the apical one, a long cutting edge between the second and third; second joint of labial palpus nearly a half longer than the first; basal joint of flagellum nearly twice the length of the second joint, the latter subequal to the pedicel; lateral ocelli subequally distant from eyes and edge of vertex; vertex flat; cheeks slightly broader than eyes; hind metatarsi considerably shorter and narrower than their tibiae; abdomen ovoid, the second to fourth tergites gradually and rather deeply depressed basally, the apical margins of the second to the fifth rather abruptly depressed toward the sides but only slightly so medially, if at all; sixth tergite triangular in dorsal aspect, the apex somewhat truncated, very nearly straight in profile, with short erect pubescence visible.

Puncturation: Fine and close on vertex, cheeks above, upper portion of face, over most of mesonotum and scutellum, and just beneath wings on pleura; becoming more coarse and distinctly separated on clypeus, cheeks and pleura below; shallow on cheeks; close on upper part of clypeus; minute and dense on abdomen basally, becoming more distinct but still fine and rather close on the fifth tergite, slightly more coarse and quite deep on the sixth.

Color: Black; antennae beneath and tegulae dark ferruginous to piceous; wings subhyaline, slightly clouded apically, the nervures ferruginous to piceous; spurs yellow.

Pubescence: Pale ochraceous above fading to whitish below on head, thorax, legs, and first abdominal tergite; a small amount of short dark pubescence intermixed with the long light hairs on vertex, but thorax without dark admixture; short and black on the third to sixth tergites, that on the second apically black, pale basally, the sixth entirely lacking pale tomentum; first to fifth tergites with entire whitish apical fasciae, that on the first obscure, the others dense and conspicuous; scopa white, entirely black on the fifth and sixth sternites.

Type.—Female; San Gabriel, Los Angeles County, California, June (C. E. Hutchinson), [U. S. N. M. no. 39987].

Paratypes.—1 ♀; Mokelumna Hill, California, (F. E. Blaisdell) [Calif. Ac. Sc.]. 1 ♀; Big Fork, Montana, June 25, 1904.

Megachile (Argyropile) nebraskana new species (Pl. XXI)

Female.—Size: Length 14 mm.; breadth of abdomen 5 mm.; anterior wing 8.5 mm.

Structure: Face somewhat broader than long; eyes slightly convergent below; clypeal margin entire, with no distinct median protuberant area or tubercle; mandible 4-dentate, a relatively long cutting edge between the two inner teeth, that between the two middle teeth obscure; basal joint of flagellum slightly longer than the second joint, the latter subequal to the pedicel; lateral ocelli considerably nearer eyes than to edge of vertex; vertex nearly flat; cheeks slightly broader than eyes; mid and hind metatarsi but slightly shorter and narrower than their tibiae; abdomen cordate, the second, third and fourth tergites somewhat depressed basally, the third to the fifth distinctly depressed across apical margins, rather deeply so on the fourth and fifth, the sixth triangular in dorsal aspect, the apex truncate or rounded, the sides very slightly incurved, straight in profile, with at most a few inconspicuous hairs visible toward the base; sixth sternite sparsely covered with short scopal hairs, the apex beyond the apical fringe upturned and thickened.

Puncturation: Close and fine on cheeks, face and pleura above; fine on the tessellate surface of the vertex and dorsum of thorax, close on vertex medially, sparse laterally, sparse on mesonotum, more close on scutellum; relatively coarse and sparse on the shining clypeus; more coarse on pleura below; minute and crowded on abdomen basally, becoming increasingly distinct and more widely separated to the fifth tergite, very fine and close on the sixth.

Color: Black; antennae more piceous beneath; tegulae more ferruginous; wings hyaline basally, faintly clouded apically, the nervures ferruginous to piceous; spurs ferruginous.

Pubescence: White on head, thorax and basal segment of abdomen, but vertex and mesonotum with rather obscure brownish pubescence; white or pale ochraceous on legs; short and dark on discs of second to fifth abdominal tergites, the sixth with appressed whitish tomentum and scattered erect white hairs toward the base; scopa entirely white.

Type.—Female; War Bonnet Canyon, Sioux County, Nebraska, July 12, 1901, on *Helianthus*, (M. Cary), [Univ. Nebr.].

Paratypes.—3 ♀; topotypical, on *Helianthus* and *Monarda*, [Univ. Nebr.]. 1 ♀; Halsey, Nebraska, July 14, 1912, on *Ratibida columnaria*, (J. T. Zimmer), [Univ. Nebr.]. 1 ♀; western Nebraska, [Univ. Nebr.]. 1 ♀; Kochler, New Mexico, August 1, 1914, 6500 feet, (W. R. Walton), [U.S.N.M.]. 1 ♀; Trego County, Kansas, 2450 feet, July 12, 1912, (F. X. Williams), [Univ. Kans.].

This species resembles *parallela* superficially, but is easily distinguished by the difference in the clypeal margin, lacking as it does the median shining area and denticle characteristic of *parallela*.

Megachile (Argyropile) sabinensis new species

Female.—Size: Length 11 mm.; breadth of abdomen 4 mm.; anterior wing 8 mm.

Structure: Face slightly broader than long; eyes very slightly convergent below; clypeal margin nearly straight, not at all protuberant medially, but with a very minute median denticle; mandible 4-dentate, a relatively long cutting edge between the two inner teeth, that between the two middle teeth obscure; basal joint of flagellum very slightly longer than the pedicel or second joint, these subequal; lateral ocelli subequally distant from eyes and edge of vertex; vertex nearly flat; cheeks subequal to eyes in width; mid and hind metatarsi only slightly shorter and narrower than their tibiae; apical angles of mid metatarsal joints not conspicuously produced; abdomen cordate, the third, fourth and fifth tergites distinctly but not deeply depressed across the apical margins, the third with a rather deep basal groove, the sixth triangular in dorsal aspect, the side straight and the apex rather narrowly truncate, straight in profile with some erect hairs visible toward the base; sixth sternite bare apically except for the apical fringe, thickened and slightly upturned just beyond the fringe.

Puncturation: Close and fine on face, cheeks, vertex medially, and over most of mesonotum and scutellum; more distinctly separated on vertex laterally and mesonotum medially, but still rather close; more coarse and deep, but quite close, on clypeus and pleura; minute and crowded on abdomen basally, becoming increasingly coarse and sparse to the fifth tergite where the punctures are rather widely separated, fine and close on the sixth.

Color: Black; antennae dark ferruginous beneath; tegulae yellowish-hyaline; wings hyaline basally, faintly clouded apically, the nervures ferruginous; spurs yellowish.

Pubescence: White on head, thorax, legs and basal segment of abdomen, but vertex with obscure darker hairs and mesonotum largely dark pubescent; short and dark on discs of second to fifth abdominal tergites, the sixth with appressed tomentum over the apical half, this silvery in large part, but brownish at apex, with some whitish erect hairs toward the base; first to fifth tergites with entire white apical fasciae, the scutello-mesothoracic suture white-fasciate, and mesonotum with a pair of anterior oblique lines of white tomentum; scopa white, entirely black on sixth sternite.

Type.—Female; Sabinal, Texas, May, 1910, (T. C. Pratt), [U.S.N.M., no. 44252].

This unique specimen is apparantly distinct from all the other species in this group. It may be distinguished from *nebraskana* by the fact that the lateral ocelli are about equally distant from the eyes and edge of vertex (these considerably nearer the eyes in *nebraskana*), by the black scopa of the sixth sternite, and by other less conspicuous details. In both *parallela* and *townsendiana* the apical angles of the mid tarsal joints are much produced, the basal portion of each joint being very slender, which is not so in this species.

Megachile (Melanosarus) floridensis new species (Pls. XX and XXI)

1930. *Megachile morio* Graenicher, Ann. Ent. Soc. Am., XXIII, p. 162. (Not Smith.)

Male.—Size: Length 13 mm.; breadth of abdomen 4.5 mm.; anterior wing 10 mm.

Structure: Face about as broad above as long; eyes slightly convergent below; clypeal margin very nearly straight and entire, very slightly incurved medially; mandible 4-dentate, the second tooth small, inferior projection robust, triangular, subbasal, with a dense tuft of pubescence on inner side of apex, seen when mandibles are open; basal joint of flagellum subequal to pedicel, second joint nearly twice as long, the apical one flattened and moderately dilated; lateral ocelli about equally distant from eyes and from each other, considerably nearer eyes than to edge of vertex; vertex flat; cheeks subequal in width to eyes; front coxae largely bare anteriorly, with moderately long spines, a patch of red bristles located antero-laterad of each spine; inferior margin of front femur quite strongly keeled apically; front tarsi (Pl. XX) enormously dilated, the second joint measured along the posterior margin fully as long as the first, the latter produced anteriorly into a deeply hollowed scale, the anterior margin of this joint therefore fully twice as long as the posterior margin, anterior margin of the second joint short, but this joint fully twice as broad as it is long, the third short but broadly dilated; mid tibia very slightly angulate on lower margin just before the apex, the metatarsus long and narrow, subequal to the tibia in length; hind metatarsus short; abdomen broad and flat, parallel-sided, the fourth and fifth tergites rather deeply depressed apically, the second and third with the apical margins depressed only at extreme sides; carina of sixth tergite short, deeply and roundly emarginate medially, apical margin of the tergite with minute acute lateral teeth, but with no evident median teeth; seventh tergite broadly V-shaped, flattened ventrally, the tip just protruding beyond the margin of the sixth tergite.

Puncturation: Moderately coarse and quite close over most of head and thorax, but distinctly separated on vertex laterally, and on mesonotum and scutellum medially; more fine on abdomen basally, becoming somewhat coarser to the fourth tergite, rather close basally, distinctly separated on the fourth, quite fine and close on the fifth, minute and crowded on the sixth.

Color: Black; antennae piceous to black beneath; tegulae dark ferruginous to piceous; wings rather heavily infuscated, the nervures brownish or ferruginous; mid and hind femora and tibiae black, their tarsi ferruginous; front coxae and trochanters largely dark, front femur yellowish-ferruginous except for the piceous apex of posterior face, the tibia ferruginous with piceous blotches on outer face, yellowish-ferruginous on the other two faces, the tarsi ivory-yellow, second joint with a black spot beneath which is margined with ferruginous; spurs yellowish.

Pubescence: Ochraceous to creamy-white on face and clypeus, cheeks below, venter of thorax, legs in large part, anterior portion of dorsum of thorax, and with small tufts of the same color in front of and behind wing bases, at posterior angles of propodeum, and at sides of basal abdominal segment; fuscous to blackish on vertex, mesonotum, scutellum, pleura above, and over most of abdomen; scutello-mesothoracic suture with a trace of an ochraceous fascia, and the third and fourth abdominal tergites with traces of basal fasciae, the second and third with slight amounts of pale pubescence apically at extreme sides; front metatarsal fringe largely white, becoming ochraceous at base, and ochraceous or brownish beneath, the metatarsus fringed anteriorly with rather long stiff brownish hairs or setae; mid metatarsi densely covered with ochraceous pubescence which forms also an indistinct and short posterior fringe.

Female.—Size: Length 11 mm.; breadth of abdomen 5 mm.; anterior wing 9 mm.

Structure: Face broader than long; eyes subparallel; clypeal margin nearly straight, the edge shining and thickened medially; mandible 5-dentate, (Pl. XXI) a long cutting edge between the second and third teeth; basal joint of flagellum subequal in length to pedicel, the second slightly longer; lateral ocelli only very slightly nearer each other than to eyes, subequally distant from eyes and edge of vertex; vertex flat; cheeks very slightly broader than eyes; all the metatarsi only slightly shorter and narrower than their tibiae; abdomen broadly cordate, quite flat, hind margins of the segments not at all depressed medially, slightly depressed at extreme sides; sixth tergite triangular, the sides straight and apex truncate, straight in profile with no erect hairs visible; sixth sternite largely bare, with a subapical fringe and a slight bare lip.

Puncturation: Close and fine on sides of face, cheeks, and on pleura above; quite coarse on clypeus, close laterally, distinctly separated medially, sparse on supraclypeal area; rather fine on dorsum of thorax, sparse on mesonotum except laterally, very sparse on scutellum which is almost impunctate; minute and sparse over most of abdomen, somewhat close on the basal segment, crowded on the sixth.

Color: Black; antennae piceous beneath; tegulae black to piceous; wings rather deeply infuscated, the nervures blackish, hind wings paler; spurs obscurely brownish or piceous.

Pubescence: Entirely black, thin above, more dense laterally and beneath; scopa entirely deep black.

Type.—Male; Miami, Florida, June 10, 1927, (S. Graenicher, no. 140), [U.S.N.M., no. 44243].

Allotype.—Female; topotypical, November 25, 1927 (Graenicher, no. 145), [U.S.N.M.].

Paratypes.—4 ♂, 1 ♀; topotypical, July 5, 1923, Sept. 25, 1924, April 19, 1923, April 13, 1926, July 29, 1927, (Graenicher). 1 ♂; topotypical, November 1911, (C. P. Engelhardt), [U.S.N.M.]. 5 ♂, 1 ♀; Palm Beach, Florida 3 (March ?), 1900, (C. F. Baker), [U.S.N.M.]. 1 ♂, 1 ♀; [Cornell Univ. Lot 239, Sub. 1].

This species was at first erroneously identified as *M. morio* Smith, and because of this error is recorded as that species by Graenicher. In a comparison of *morio* with *xylocopoides*, following the original description[22] it is stated that it differs "in having the vertex more deeply emarginate, the thorax more closely punctured, the scutellum nearly covered with pubescence and rounded behind, the anterior legs not rugose, and the abdomen much more pubescent." This species does not fit this description at all, since the thorax is slightly more sparsely punctate than in

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[22] *Megachile morio* Smith, Cat. Hym. Brit. Mus., I, p. 189. (1853)

xylocopoides, the scutellum nearly bare of pubescence and broadly triangular in shape rather than rounded behind, and the abdomen is very sparingly pubescent, as in *xylocopoides*. Graenicher records the species from the following flowers: *Poinsettia cyathophora*, *Melanthera brevifolia* and *Bidens leucantha*.

Megachile (Chelostomoides) ignacensis new species (Pl. XXI)

Female.—Size: Length 13 mm.; breadth of abdomen 3 mm.; anterior wing 8.5 mm.

Structure: Face broader than long; eyes subparallel; clypeus very short, with a median rounded lobe, and on each side an oblique truncate lobe, deeply emarginate between these, while below and between them is a shining impunctate face about twice as long as wide; mandible robust, with a slight basal dilation beneath, with four sharp teeth, the two middle ones rather widely separated, and with a short rounded basal tooth above; cheeks slightly narrower than eyes, each with a small tooth just behind the base of the mandible; vertex convex; lateral ocelli nearer eyes than to edge of vertex; basal joint of flagellum slightly shorter than pedicel, the second joint about equalling the pedicel; each front and middle tibia terminated by a rather long curved sharp spine, all the metatarsi much shorter and narrower than the respective tibiae; second to fourth abdominal tergites with basal grooves, their apical margins depressed laterally.

Puncturation: Rather coarse and sparse on cheeks below, more fine and close above, moderately large, deep and well separated on vertex, fine and deep on supraclypeal area, close laterally but more sparse medially, the clypeus with scattered strong punctures medially, the lateral lobes with several long deep striate punctures between which the surface is polished; close and deep on mesonotum, more separated on scutellum, close and strong on pleura, fine and close but distinct on propodeum; coarse and sparse on first to fourth abdominal tergites, more close on the fifth, fine and close on the sixth.

Color: Black; antennae reddish beneath; tegulae dark ferruginous; wings subhyaline, faintly clouded apically, the nervures ferruginous; legs dark red to piceous; spurs yellowish.

Pubescence: Whitish on sides of face and between antennae, thin and white on cheeks, short thin and dark on vertex; short and fuscous on mesonotum, whitish on pleura, propodeum and legs, the mesonotum with two conspicuous oblique lines of ochraceous tomentum anteriorly, and with a similar line over each tegula, the scutello-mesothoracic suture ochraceous-fasciate; basal grooves of abdominal tergites ochraceous-fasciate, the first to fourth tergites with entire narrow ochraceous apical fasciae, broader on the fourth, the pubescence of the discs of these tergites hardly discernible, apparantly dark, the fifth tergite with erect black pubescence and fringed apically with short black hairs, the sixth with pubescence largely appressed, ochraceous basally, blackish apically; scopa yellowish-white, black on sixth sternite.

Type.—Female; San Ignacio, Lower California, April 1909, (Haines), [A.N.S.P. no. 4163].

This had been identified as *Lithurgus oblongus* (*Megachile longula*) Fox, but is quite different. The nearest affinity apparantly is *prosopidis*, but it differs from the latter in the broadly truncate lateral clypeal lobes (these being acute in *prosopidis*), and the 4-dentate mandible, with distinct inferior and superior basal dilations or protuberances, the mandibles being distinctly 5-dentate in *prosopidis*, with the superior basal protuberance small and inconspicuous and the inferior basal dilation lacking. The inner tooth of the mandible of *ignacensis* is blunt and slightly emarginate, giving an approach to the 5-dentate condition.

Megachile (Chelostomoides) duplexa new species (Pl. XXI)

Male.—Size: Length 6.5 mm.; breadth of abdomen 2 mm.; anterior wing 5 mm.

Structure: Face longer than broad; eyes slightly converging below; clypeal margin with a rounded median emargination; mandible 3-dentate, with no inferior projection; cheeks narrower than eyes, slightly narrowed above; lateral ocelli subequally distant from eyes and edge of vertex; antennae almost as long as head and thorax combined, basal joint of flagellum about equal to the pedicel, the following joints three times as long, the apical one neither dilated nor flattened; coxal spines absent; front tarsi simple; basal grooves of abdominal tergites pronounced; carina of sixth tergite low and inconspicuous, the median teeth of the apical margin of the tergite nearer the lateral teeth than to each other; seventh tergite obtuse, the apex slightly concave.

Puncturation: Indistinct on mandibles, close on cheeks, more distinctly separated on vertex; crowded laterally on mesonotum and scutellum, but definitely separated medially, coarse and distinct on pleura, but more fine and close anteriorly; tegulae polished and impunctate; punctures well separated on abdomen basally, more close on the fifth tergite and crowded on the sixth.

Color: Black; antennae ferruginous, somewhat darker above; tegulae yellowish; wings hyaline, faintly clouded apically, the nervures piceous; legs black to piceous; spurs yellow; apical margins of second to fourth abdominal tergites yellowish-hyaline, and the apical margin of the sixth (not the carina) narrowly ferruginous.

Pubescence: Entirely white except for some very short inconspicuous dark pubescence on second to fourth abdominal tergites; very dense on face and clypeus, quite long and conspicuous on cheeks and pleura, otherwise thin; two short oblique patches of dense white tomentum on mesonotum anteriorly, and the scutello-mesothoracic suture with a bare trace of a white fascia; first abdominal tergite with a white apical fascia which is dense alterally, the second and third with the apical fasciae evident only laterally, but the third to the sixth with dense white basal fasciae; the sternites with conspicuous white apical hair fringes.

Type.—Male; Alamogordo, New Mexico, April 19, 1902, [A.N.S.P. no. 4164].

Paratype.—1 ♂ (with abdomen missing); topotypical.

Megachile (Chelostomoides) browni new species (Pl. XXI)

Male.—Size: Length 8 mm.; breadth of abdomen 2 mm.; anterior wing 6 mm.

Structure: Face broader than long; eyes subparallel; clypeal margin broadly produced, the process slightly emarginate medil ally; mandible 3-dentate, with no inferior projection; latera-ocelli subequally distant from eyes and edge of vertex; antennae almost as long as head and thorax combined, basal joint of flagellum subequal in length to pedicel, the second and following joints about four times this length; front coxae not spined; tarsi simple; abdominal tergites quite deeply grooved basally; carina of sixth tergite very low and inconspicuous, shallowly emarginate medially, the apical margin of the tergite with low carinate median teeth; seventh tergite low and inconspicuous, concave apically.

Puncturation: Close and fine on cheeks, coarser, deeper and more widely separated on vertex, both of these areas shining; deep and rather close on mesonotum, somewhat finer on scutellum and pleura, the surface shining between the punctures; a few minute punctures on the tegulae; outer faces of tibiae polished and finely and sparsely punctate; second to fourth abdominal tergites shining, the punctures about as on mesonotum, the fifth and sixth more finely and closely punctate; sternites finely and closely punctate, the third subrugose.

Color: Black; antennae reddish; tegulae reddish-yellow; wings hyaline, the nervures piceous; legs piceous to black; spurs pale yellow; carinate apical margin (not the carina) of sixth tergite ferruginous.

Pubescence: Entirely whitish, with no admixture of dark hairs, thin in general, but quite dense on anterior margin of mesonotum, the latter with two short oblique anterior lines of white tomentum, the scutello-mesothoracic suture inconspicuously white-fasciate; first abdominal tergite with a broad dense white apical fascia which is widely interrupted medially, the second to the sixth with entire conspicuous white basal fasciae, the apical fasciae inconspicuous and noticeable only laterally; sternite with entire and quite dense white apical fasciae.

Type.—Male; Yuma, Arizona, June, 1905, (Hbt. Brown), [U.S.N.M. no. 40568].

Paratype.—1 ♂; topotypical.

Megachile (Chelostomoides) manni new species (Pl. XXI)

Female.—Size: Length 14 mm.; breadth of abdomen 3.5 mm.; anterior wing 9 mm.

Structure: Face broader than long; eyes slightly divergent below; clypeus with two distinct faces divided by an arcuate edge, the upper face very short, the lower one longer medially than the upper one, but not as broad; mandible long, not much broadened apically, but with four distinct apical teeth and a trace of a fifth between the third and fourth, and with an inner tooth near the base; labrum quite long; cheeks shining and bare on inferior angle, the lateral faces below broader than eyes, narrower above; lateral ocelli subequally distant from eyes and edge of vertex; basal joint of flagellum shorter than pedicel, the second joint but very slightly longer; mid and hind metatarsi about as long and wide as their tibiae; second to fourth tergites with distinct basal grooves, the sixth very slightly convex in profile, but with an abrupt apical lip (largely obscured by pubescence), triangular in dorsal aspect, the sides straight and apex rounded.

Puncturation: Fine on the shining inferior face of cheek, more coarse but close on the lateral face; close and quite deep on the shining vertex and upper face of clypeus, the lower face shining and impunctate, deep on the shining supraclypeal area where they are sparse medially but close laterally; close and quite deep on mesonotum, somewhat more fine and close on scutellum, deep and close on pleura; tegulae minutely punctate; concavity of basal abdominal tergite with a punctate area on each side of the median line where the punctures are quite deep and conspicuous, coarser and more widely separated on the disc, becoming very fine and close on the apical tergites.

Color: Black; antennae obscurely reddish beneath; tegulae fuscous to ferruginous; wings subhyaline, more distinctly infuscated apically, the nervures fuscous to ferruginous; spurs pale yellow.

Pubescence: Entirely white on face below antennae, on cheeks, pleura (except for a small patch of dark hairs just beneath wings), propodeum, legs and abdomen; long and blackish on vertex, between antennae and on scutellum, much shorter and blackish on mesonotum, but this whitish anteriorly and with a dense white marginal patch just behind wings, the scutello-mesothoracic suture white-fasciate; second to fifth abdominal tergites with both basal and apical entire white fasciae, the first fasciate only laterally, pubescence of the discs of the second and third extremely short and inconspicuous, that on the sixth quite conspicuous, with a golden tint; scopa whitish, tending to ochraceous apically.

Male.—Size: Length 12 mm.; breadth of abdomen 3.5 mm.; anterior wing 8 mm.

Structure: Face broader than long; eyes slightly divergent below; clypeal margin with prominent tubercles; mandible 3-dentate, without an inferior projection, with a shining slightly curved ridge extending from base to apex; cheeks below about as broad as eyes, narrower above; lateral ocelli slightly nearer edge of vertex than to eyes; antennae shorter than head and thorax, basal joint of flagellum about equal to the pedicel, the second joint more than twice this length; front tarsi simple; coxae without spines; second to fifth abdominal tergites quite deeply grooved basally, the apical margins more conspicuously depressed toward the sides; carina of sixth tergite low and inconspicuous, roundly emarginate medially, median teeth of apical margin of the tergite carinate, the lateral teeth short and acute; seventh tergite largely obscured by the dense pubescence.

Puncturation: Close, quite deep and evenly distributed on cheeks and vertex, crowded and deep on clypeus; close and deep on mesonotum, close on scutellum and pleura; tegulae with scattered minute punctures; fine and close on basal abdominal tergite, the concavity with a punctate area on each side of middle; punctures close medially but more widely separated laterally on second to fourth tergites, very fine and close on the fifth and sixth; quite close and fine on the exposed sternites, relatively more coarse on the third.

Color: Black; antennae obscurely reddish beneath; tegulae fuscous to blackish; wings subhyaline, clouded apically, the nervures fuscous to ferruginous; spurs yellowish; apical margins of second to fourth abdominal tergites transparent reddish-yellow.

Pubescence: White in general, entirely so on cheeks, legs. sternum, propodeum and abdomen; long and blackish on vertex and scutellum, shorter and blackish on mesonotum posteriorly, pleura with a few dark hairs just beneath wings, and face and clypeus with scattered long dark hairs intermixed with the more conspicuous white pubescence; scutello-mesothoracic suture white-fasciate; second to fourth abdominal tergites with conspicuous white basal fasciae, apically at most subfasciate toward sides, the fifth and sixth tergites with broad basal fasciae, the discs with thin yellowish pubescence; abdominal sternites fasciate apically, that on the first entire, interrupted medially on the second and third.

Type.—Female; Ramsey Canyon, Huachuca Mountains, Arizona, (W. M. Mann), [U.S.N.M. no. 40567].

Allotype.—Male; topotypical.

Paratypes.—6 ♀ and 1 ♂; topotypical.

Megachile (Chelostomoides) spinotulata new species (Pl. XXI)

Female.—Size: Length 11 mm.; breadth of abdomen 2.5 mm.; anterior wing 6 mm.

Structure: Face longer than broad; eyes subparallel; clypeus (see figure) flat, the apical margin with a rather broad median emarginate area in the center of which is a prominent tubercle; mandible broad, distinctly 5-dentate, with a shining ridge extending from base to apex which divides the surface into lower and anterior faces, each of these being subdivided by similar ridges; cheeks narrower than eyes, slightly narrowed above; lateral ocelli subequally distant from eyes and edge of vertex; antennae short, basal joint of flagellum about half the length of the pedicel, the middle joints slightly longer than broad; hind metatarsi much narrower than their tibiae; second to fifth abdominal tergites with deep basal grooves, the sixth abruptly descending (vertical), with a very deep groove just before the apex, the upper margin of this groove carinate.

Puncturation: Fine and close on the shining cheeks, larger and more separated on the shining vertex, close and coarse on clypeus except the upper margin and a median impunctate line, the punctures numerous but well separated on the shining supraclypeal area; rather close and fine on mesonotum and scutellum, close on pleura; tegulae with a few indistinct punctures; coarse and scattered on the shining abdominal tergites, very close on the first, fine but separated on the sixth.

Color: Black; antennae reddish beneath; tegulae reddish-yellow; wings subhyaline, the nervures piceous to brownish; legs dark; spurs yellow.

Pubescence: White on head, conspicuous on inner orbits, thin elsewhere, very short and tinged with yellow on vertex and around ocelli; mesonotum with two short oblique lines of white tomentum anteriorly and a conspicuous line behind each tegula, the scutello-mesothoracic suture white-fasciate, the mesonotum otherwise with very short yellowish pubescence; thin, long and whitish on scutellum, rather dense and white on pleura, long on posterior face of propodeum; white on legs, but brownish-yellow beneath tarsi; basal grooves of abdominal tergites densely white-fasciate, the first to the fourth with entire narrow yellowish apical fasciae which are broader laterally, disc of the first with white pubescence, very short, thin and blackish on the more apical tergites, the fifth with a distinct apical fringe of short black bristles, the sixth above the apical groove with subappressed brownish pubsecence, that below the groove to the apex very dense and purplish-brown; scopa white, short, dense and dark brown on the sixth sternite.

Male.—Size: Length 9.5 mm.; breadth of abdomen 2.5 mm.; anterior wing 6 mm.

Structure: Face about as long as broad; eyes parallel; clypeal margin (see figure) with two rather large rounded projections and between these a slight median one; mandible 3-dentate, the inferior projection subbasal, with a thickened apex and shallowly grooved; cheeks rather narrow, the inferior angle with an impunctate concavity, the inner margin of which is produced into a short, broadly truncated, carina-like tooth; vertex slightly convex; lateral ocelli slightly nearer edge of vertex than to nearest eye; basal joint of flagellum subequal in length to pedicel, the second joint nearly twice this length, the apical one slightly flattened but not dilated; mesosternum with a short pointed spine just behind each front coxa; coxal spines long, somewhat flattened, rounded apically and strongly divergent, a second smaller, sharply pointed spine just anterior to these; front tarsi (see figure) broadly dilated, the outer surface hidden by dense appressed white pubescence, the first two joints subequal in length and both very deeply excavated anteriorly, the resulting scale on the second joint somewhat produced apically but not attaining the tip of the third joint, the third and fourth joints much less dilated, the fifth normal, the tarsal fringe very short; mid metatarsus rather slender, slightly fringed posteriorly; hind femora squarish in cross-section; abdominal tergites rather broadly and deeply grooved basally, the apical margins of the more apical tergites quite deeply depressed, especially laterally; carina of sixth tergite (see figure) very deeply and broadly emarginate medially, resulting in two large truncated teeth, the apical margin of the tergite with rather acute median teeth which are about equally distant from each other and from the large truncate carina-like lateral teeth; seventh tergite quite conspicuous, emarginate medially.

Puncturation: Close and fine on cheeks, deep and sparse on the shining vertex, close and deep between the ocelli, deep and more scattered on the clypeus laterally, impunctate medially; deep and well separated but evenly distributed on mesonotum and scutellum, sparse and deep on pleura above, closer below, the surface shining; tegulae impunctate; upper face of front femur polished and impunctate, the posterior face sparsely punctate; punctures large and deep but well separated on abdomen, rather sparse apically, close and coarse on the sixth tergite above the carina.

Color: Black; mandibles ferruginous; cheeks reddish below; antennae reddish beneath; tegulae reddish yellow; wings subhyaline, the marginal cell infuscated, the nervures piceous; legs ferruginous, the front coxae darker, the front legs otherwise paler ferruginous, second and third joints of front tarsi with black spots beneath; spurs pale yellow; abdomen suffused with red basally, the apical margins of the tergites yellowish-hyaline, the seventh tergite ferruginous.

Pubescence: White on face, tinged with yellowish medially, dense long and white on clypeus laterally, yellowish on vertex, thin and white on cheeks, appressed along posterior orbits, with some short dark hairs above eyes; entirely white on thorax, thin and short on mesonotum, more dense below, with two conspicuous lines of white tomentum anteriorly and with similar dense lines back of tegulae and in the scutello-mesothoracic suture; white on legs, largely appressed on front tibiae and tarsi, as also on the hind legs, the front tarsal fringe yellowish-brown beneath, white above, the tarsal scale fringed with yellowish-brown hairs; second to sixth abdominal tergites with broad entire white basal fasciae, the first to the fourth with apical fasciae evident laterally, the discs of the tergites with short inconspicuous black pubescence; apical margin of second sternite with dense white pubescence, the third with similar pubescence on the disc and with a median longitudinal row of ochraceous setae extending about half the length of the plate.

Type.—Male; Los Angeles County, California, (Coquillett), [U.S.N.M., no. 39981].

Allotype.—Female; topotypical, [U.S.N.M.].

Paratypes.—2 ♀; Highrolls, New Mexico, [A.N.S.P.]. 1 ♀; Arizona, [A.N.S.P.]. 3 ♀, 1 ♂; Alamogordo, New Mexico, June, [A.N.S.P.]. 1 ♂, 1 ♀; Camp Baldy, California, August 22, 1920, 4800 feet, (Timberlake). 1 ♂, 1 ♀; Jacumba, California, August 12, 1917, [Geo. Salt]. 1 ♂; Tucson, Arizona, July 31, 1924, (E. P. VanDuzee), [Calif. Ac. Sc.]. 1 ♂; San Antonio Canyon Ontario, California, June 20, 1931, 5300 feet, (H. A. Scullen).

Megachile (Chelostomoides) subspinotulata new species (Pl. XXI)

Female.—Size: Length 8.5 mm.; breadth of abdomen 2 mm.; anterior wing 6 mm.

Structure: Face somewhat longer than broad; eyes slightly converging below; clypeal margin with a broad and shallow emargination on each side of a small median tubercle, slightly crenulate laterad of these; mandible broad apically, with four distinct teeth and a dentiform angle just before the inner tooth, resulting in an approach to the 5-dentate condition, and with two shining ridges extending from the apical tooth about half way to the base, and a third sinuate ridge extending from the second tooth to the upper margin near the base; cheeks narrower than eyes, slightly narrower above; vertex convex; lateral ocelli slightly nearer eyes than to edge of vertex; antennae short, basal joint of flagellum shorter than pedicel, the second about equal to the first in length but much broader, middle joints but slightly longer than broad; mid and hind metatarsi much shorter and narrower than their tibiae; second to fourth abdominal tergites with deep basal grooves, the fifth with a shallower basal groove, the sixth abruptly descending and with a very deep groove just before the apex, the anterior margin of this groove carinate.

Puncturation: Fine, rather close, and evenly distributed on the shining cheeks, deeper and more widely separated on vertex, coarse and quite close on clypeus, rather coarse on supraclypeal area; close and fine on mesonotum, more sparse on the shining scutellum, irregular on the pleura; minute on tegulae; close and fine on basal abdominal tergite, more sparse and scattered on the second to the fifth, rather fine and close on the sixth.

Color: Black; antennae red beneath; tegulae yellowish medially, piceous anteriorly and posteriorly; wings subhyaline, faintly clouded apically, the nervures piceous to ferruginous; spurs yellowish.

Pubescence: White on inner orbits, cheeks, pleura and legs, and dense and white in front of mid coxae and on first abdominal tergite laterally; thin and pale on clypeus, mesonotum, first abdominal tergite medially and on second to fourth tergites; thin and dark on vertex and on second to fourth tergites apically; mesonotum with two oblique lines of creamy tomentum anteriorly, a small tuft of the same color behind each tegula, and a similar fascia in the scutello-mesothoracic suture; basal grooves of second to fifth abdominal tergites white-fasciate, the first to the fourth with apical fasciae which are cream-colored medially but pure white laterally, the fifth having an apical fringe of black hairs, the sixth with a broad white basal fascia, otherwise with subappressed brownish pubescence; scopa white, short, rather dense and dark brown on the sixth sternite.

Type.—Female; Coyote Mountains, Arizona, about 3500 feet, August 4–7, 1916, [Am. Mus. Nat. Hist.].

This is very close to *spinotulata* but may be distinguished by its smaller size, the different character of the clypeal margin, and by the dentition of the mandibles.

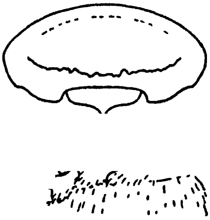
EXPLANATION OF PLATES

PLATE XX

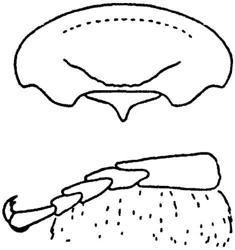
Carina of sixth abdominal tergite and front tarsus of males of new species of the subgenus *Xeromegachile*, and front tarsus of *Melanosarus floridensis*.

PLATE XXI

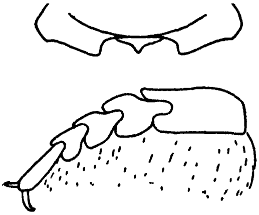
Specific characters in new species of the subgenera *Anthemois*, *Xanthosarus*, *Xeromegachile*, *Megachiloides*, *Argyropile*, *Melanosarus* and *Chelostomoides*.



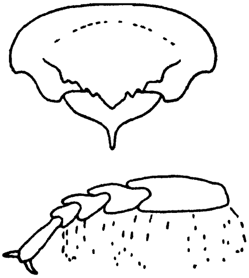
WYOMINGENSIS

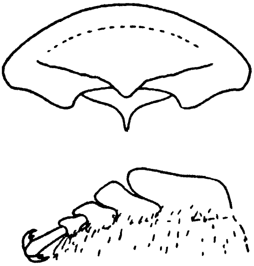


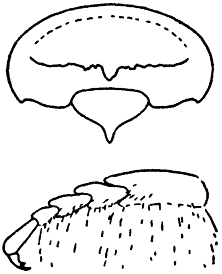
BRUNERI

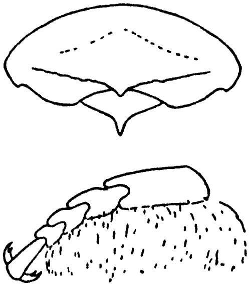


VICTORIANA

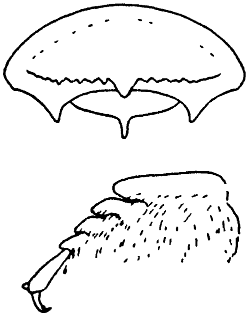




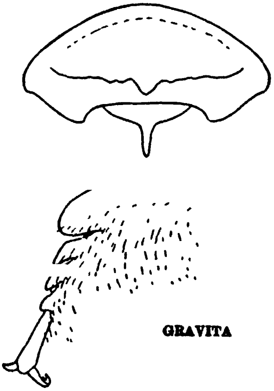




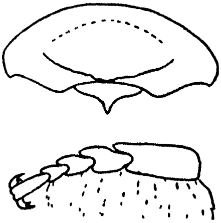
PALMENSIS



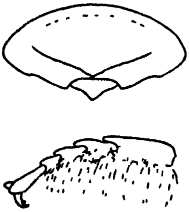
BAKERI



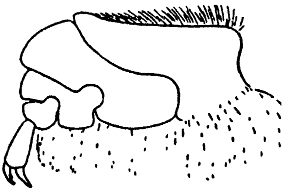
GRAVITA



FUCATA

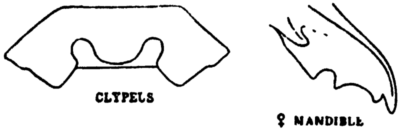


INSTITA

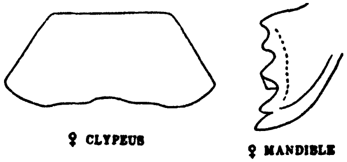


FLORIDENSIS

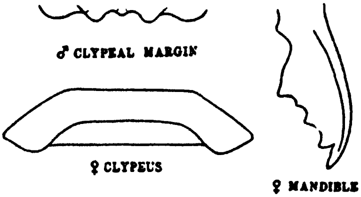
MITCHELL—NEARCTIC MEGACHILE



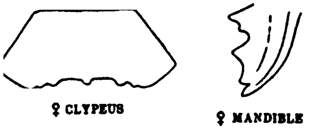
IGNACENSIS



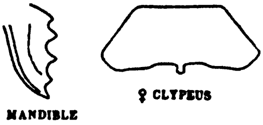
SANTIAMENSIS



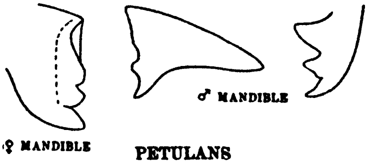
MANNI



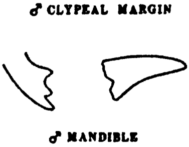
SUBSPINOTULATA



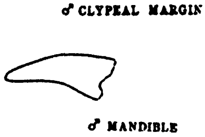
SPINOTULATA



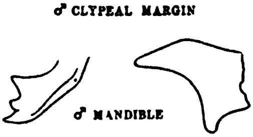
PETULANS



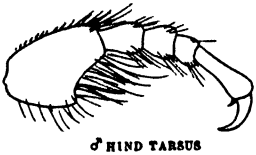
DUPLEXA



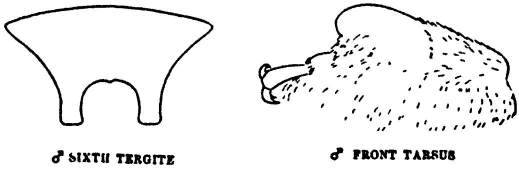
BROWNI



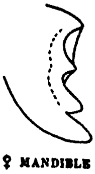
SPINOTULATA



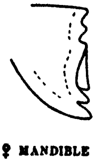
COCHISIANA



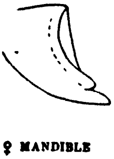
SPINOTULATA



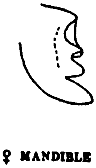
NEBRASKANA



FLORIDENSIS



GABRIELENSIS



IMPARTITA

MITCHELL—NEARCTIC MEGACHILE

STUDIES IN ORTHOPTERA WHICH OCCUR IN NORTH AMERICA NORTH OF THE MEXICAN BOUNDARY

BY MORGAN HEBARD

(Plate XXII)

For some years T. H. Hubbell and the author have been preparing a list of the Orthoptera found in North America north of the Mexican boundary. So much work is still necessary before such a list can be successfully handled that it is evident that publication would for some time to come be inadvisable.

In the unstudied collections assembled at the Academy of Natural Sciences are a number of undescribed species from that area, and other series give conclusive evidence that certain names have been misapplied. In order to dispose of a number of these problems we have decided to publish a series of short papers from time to time, of which the two following are now ready.

I. PSYCHOMASTAX, A GENUS OF GRASSHOPPER OF THE WESTERN UNITED STATES

(ACRIDIDAE, EUMASTACINAE)

Rehn and Hebard described *Psychomastax* in 1918, basing it on the single species *psylla*, distinguished from the races of *Morsea* Scudder by the more robust form, broader head, less projecting fastigium, antennal tooth on ninth instead of tenth segment, less broadly rounded ventro-caudal angles of the pronotal lateral lobes, simple and styliform instead of falcate male cerci and male subgenital plate with dorso-lateral portions curving and narrowing as triangular flaps, which meet to form the disto-dorsal portion, where no linguliform process is developed.

One hundred and forty specimens now added to the ten originally described disclose the presence of two geographic races, both distinguished from typical *psylla* by being even more robust with shorter vertex and so diverging even more strongly from *Morsea* in general appearance.

Like those of *Morsea*, the races of *Psychomastax* are thamnophilous but often are found on the ground among the bushes in which they live. Such bushes are the Chamisal (very characteristic of the chaparral of the hills and mountains of southern California), wild gooseberry, Antelope Brush and Mountain Mahogany. The insects apparently often seek shelter also in the Junipers when found where these small trees occur.

These diminutive insects usually rest with caudal limbs much more divergent from the body than is usual in grasshoppers, their leaps suggesting the use of those members as a cross-bow with their body the arrow. Though their leaps may be extremely quick, the impression is often given that they rely to some extent on immobility, often pausing and when motionless being remarkably protected both by coloration and form.

The three races may be distinguished as follows:

A. Form distinctly less robust (though more robust than in *Morsea*). Fastigium briefly but distinctly projecting (this not as plainly evident in males as in females). Fastigio-facial angle in lateral aspect rectangulate (this more evident in males than in females). Eye elongate. (Size small. Frontal costa narrow with expansion dorsad weaker and between antennae often weak in males and very weak in females.) Southern Sierras and Ventura Mountains south to San Jacinto Mountains, California...... .*Psychomastax psylla psylla* Rehn and Hebard

AA. Form distinctly more robust. Fastigium not or very briefly projecting. Fastigio-facial angle in lateral aspect slightly greater. Eye shorter.

B. Size small. Fastigium very briefly or briefly projecting, the fastigio-facial angle projecting beyond eyes less than in *psylla psylla*. Frontal costa broad, with expansion dorsad very decided and between antennae usually prominent. Eye short. Mountains of southern Nevada and adjacent California.......*Psychomastax psylla robusta* new subspecies

BB. Size very small. Fastigium not or very briefly projecting, the fastigio-facial angle in lateral aspect least projecting between eyes. Frontal costa as in *psylla psylla*. Eye shortest and broadest. Base of San Jacinto Mountains near Mojave Desert, California.
Psychomastax psylla deserticola new subspecies.

Though in *psylla psylla* the immediate fastigio-facial angle is rectangulate (as was originally stated) the planes of the vertex and of the frontal costa form an angle distinctly less than a rightangle particularly in the female sex. This angle in *psylla robusta* averages wider and in *psylla deserticola* shows nearest approach toward a rightangle.

Like the races of *Morsea,* these are difficult to distinguish, due to the majority of the characters being of degree only. Moreover, in all, the average males have the fastigial projection less than in females of the same race.

The caudal femora in *psylla deserticola* are proportionately shorter than in the other series, but this is probably only in conformity with altitudinal variation such as has been observed for *Morsea californica californica* Scudder.

Psychomastax psylla psylla Rehn and Hebard (Pl. XXII, figs. 1 and 2)

Of the present material the Round Valley female is typical. The series from the San Bernardinos shows variation, many of the females being less elongate than the allotype from the San Jacintos, some having the vertex quite as produced but others with the vertex showing definite divergence toward *psylla robusta.* The pair from the Ventura Mountains resembles these latter. It is quite possible that additional material will show *psylla psylla* to be consistently typical nowhere north of the San Jacinto Mountains.

Specimens Examined: 21; 4 males and 17 females.

California: Above Round Valley, summit of lava flow, Inyo County, 7280 feet, IX, 11, 1919, (Rehn; beaten from Antelope Brush, *Purshia tridentata,* in Zone of Juniper and Pinyon), 1 ♀. Cuddy Canyon, Ventura Mountains, 4472 feet, IX, 4, 1922, (Rehn and Hebard; very scarce in *Purshia tridentata* growing as large bushes in wash), 1 ♂, 1 ♀. Vivian Creek, San Bernardino Mountains, 7200 to 7800 feet, VIII, 29, 1919, (Rehn and Hebard; moderately numerous in forest of Sugar Pine, *Pinus lambertiana,* Incense Cedar, *Libocedrum decurrens* and Douglas Fir, *Pseudotsuga mucronata,* about patches of a low gray-green leaved spiny shrub, also seen on ridge toward High Creek up to its summit in chaparral), 3 ♂, 15 ♀.

Psychomastax psylla robusta new subspecies (Pl. XXII, figs. 3 and 4)

Among the largest and conspicuously the most robust of the Eumastacids found within the United States, this race may be distinguished by the characters given in the present key and below.

It occurs in the desert mountains of southern Nevada and adjacent eastern California from the Zone of Juniper and Pinyon upward to over 11000 feet. Under *psylla psylla* we note the unexpected presence of that race as far north as Inyo County, California, more material being needed to determine why both of these races occur at localities near the northern limit of the genus on the eastern slopes of the Sierra Nevada and the exact extent of their areas of intergradation.

Type.—♂; Charleston Peak, Spring Mountain Range, Nevada. Elevation 10200 feet. August 19, 1919. (Hebard.) [Hebard Collection, Type No. 1247.]

Size large (averaging slightly larger and form distinctly more robust than *psylla psylla*). Fastigium in dorsal aspect projecting slightly more cephalad than the eyes, this intermediate between *psylla psylla* and *psylla deserticola;* definitely broader than in the former, medio-longitudinal carina equally pronounced. Width of apex of fastigium faintly over three-fifths dorsal width of eye. Fastigio-facial angle full rectangulate, but plane of upper portion of frontal costa much more nearly vertical to that of vertex than is the case in this sex of *psylla psylla.* Frontal costa with dorsal and median expansion decided. Apterous. Eye, pronotum and genitalia as in that race.

Allotype.— ♀; same data as type. [Hebard Collection.]

Agrees closely with male but decidedly larger and more robust. Fastigium broader and projecting slightly more cephalad. Dorsal width of eye three-quarters apical width of fastigium. Eye longer than in male, as in *psylla psylla,* but similarly distinctly less broadly and evenly rounded than in *psylla deserticola.*

These racial characteristics are all more accentuated in females than in males.

Majority of specimens very dark slaty brown; usually with lateral lobes of pronotum whitish ventrad, this broadest caudad; face, dorsum and limbs slaty; the caudal femora often appearing triannulate. Rarely (♀ Belted Range, 1 ♀ Lone Pine Canyon, 1 ♀ Whitney Pass) the general coloration is much lighter, light brown marbled with buff, the latter distinctly tinged with olivaceous in the first specimen, faintly so in the other two. A vittate type also occurs (Charleston Peak, 1 ♂, 2 ♀) in which the ground color is light reddish brown, immaculate and palest on the dorsum, with a very broad post-ocular band of dark red-brown running to the apex of the abdomen and with caudal femoral annuli very feebly indicated. Such specimens were taken in the needles under the Bristle-Cone Pines and their protective resemblance to that environment was noted at the time. Individual color variation is great and numerous combinations of the color phases described above occur, but the slaty brown phase is much the most frequently encountered.

On the slopes of Charleston Peak we noted that males were more agile than females, but both very much slower than those of the very active *Morsea.* All jumped down hill, the females usually taking one or two, the males several long leaps. Between each leap individuals paused and seldom altered their direction before again leaping as do most grasshoppers.

	Length of body	Length of antenna	Length of pronotum	Length of cephalic femur	Length of caudal femur
♂					
Lee Canyon, Spring Mountain Range, Nevada. 6000 feet. *Paratype*	11.8	2.35	2.1	2.5	8.
Lee Canyon, Spring Mountain Range, Nevada. 8000 to 8500 feet. *Paratype*	10.6	—	1.9	2.9	8.2
Charleston Peak, Nevada. 10200 feet. *Type*	10.	2.6	1.6	2.75	7.9
Charleston Peak, Nevada. 10200 feet. *Paratype*	8.8	2.25	1.7	2.7	7.8
Charleston Peak, Nevada. 10200 feet. *Paratype*	10.6	3.1	2.	3.2	8.7
Charleston Peak, Nevada. 11500 feet. *Paratype*	9.	2.7	1.8	2.8	7.8
Goat Spring, White Mountains, California. 10743 feet	9.	2.2	1.75	2.5	7.7
♀					
Belted Range, Nevada. 6700 feet	20.	—	2.75	2.7	9.2
Lee Canyon, Spring Mountain Range, Nevada. 7200 feet. *Paratype*	18.1	2.	2.5	2.7	9.3
Charleston Peak, Nevada. 8900 to 9600 feet. *Paratype*	20.6	2.5	3.	3.6	10.8
Charleston Peak, Nevada. 10200 feet. *Allotype*	19.4	2.4	2.7	3.	10.
Panamint Range, California. 7300 feet	19.2	2.2	2.75	3.	10.3
White Mountains, California. 9500 feet	17.	2.	2.6	2.1	8.4

The average width of the fastigium and frontal costa is distinctly greatest in the Belted Peak and Spring Mountain Range material, so that in the more western individuals slight divergence toward *psylla psylla* is evident. The fact that in the northern portion of the range of *psylla psylla* slight divergence toward the present race often occurs makes such material more difficult to distinguish than is the case with typical specimens of these races.

Specimens Examined: 72; 31 ♂; 36 ♀ and 5 immature individuals.

NEVADA: West base of Belted Peak, Nye County, 6700 feet, VIII, 25, 1924, (Hebard; resting at night on foliage of Juniper five feet from ground, found while searching for *Aglaothorax*, lower portion of Juniper and Pinyon Zone), 1 ♀. Lee Canyon, Spring Mountain Range, 6000 feet, VIII, 18, 1919, (Rehn; beaten from Juniper about six feet from ground, in Juniper and Pinyon Zone), 1 ♂, *paratype;* 7200 feet, VIII, 20, 1919, (Rehn and Hebard; beaten from or near Pinyon and from Wild Gooseberry, *Grossularia* sp., in Juniper and Pinyon Zone), 1 ♂, 1 ♀, *paratypes;* 8000 to 8500 feet, VIII, 19, 1919, (Rehn and Hebard; Zone of Western Yellow Pine, *Pinus ponderosa*), 1 ♂, *paratype;* 8000 to 8600 feet, VIII, 1, 1930 and VIII, 14 and 15, 1931, (E. R. Tinkham), 12 ♀, 8 ♀, *paratypes*, 1 juv. ♂, 3 juv. ♀; 8900 to 9600 feet, VIII, 14 and 15, 1931, (E. R. Tinkham; on rocks), 1 ♀, *paratype;* 9000 feet, VIII, 1, 1930, (E. R. Tinkham), 1 ♂, *paratype.* Charleston Peak, Spring Mountain Range, 9000 to 11400 feet, VIII, 14, 1931, (E. R. Tinkham), 2 ♂, 2 ♀, *paratypes;* 10200 feet, VIII, 19, 1919, (Hebard; colony on rocky and very steep slope, majority on ground with a few Wild Gooseberry and mountain plants there, a few under Bristle Cone Pines, *Pinus aristata*, Canadian Zone), 10 ♂, 11 ♀, *type, allotype, paratypes;* 11500 feet, VIII, 15, 1931, (E. R. Tinkham; rare on upper slopes), 1 ♂, *paratype.*

CALIFORNIA: Upper Wild Rose Canyon, Panamint Range, Inyo County, 7300 feet, IX, 6, 1922, (Hebard; in sage brush, Juniper and Pinyon Zone), 1 ♀. Near Goat Spring, White Mountains, Inyo County, (summit), 10730 feet, IX, 10, 1919, (Hebard; beaten from Wild Gooseberry on almost bare slope of shaly dust among Bristle Cone Pines), 1 ♂. Silver Canyon trail, White Mountains, Inyo County, 9500 feet, IX, 10, 1919, (Rehn and Hebard; on ground among few Wild Gooseberry bushes, upper edge of Zone of Juniper and Pinyon), 1 ♂, 1 ♀. Upper Meadows, Whitney Pass trail, High Sierras, Inyo County, 10700 feet, IX, 6, 1919, (Hebard; on bare white decomposed granite gravel and on granite boulders, upper edge of Zone of Fox-tail Pines, *Pinus balfouriana*), 5 ♀. Lone Pine Canyon, Sierra Nevada, Inyo County, 8000 to 8370 feet, IX, 5 and 8, 1919, (Rehn and Hebard; scarce on almost bare slopes between bushes of Mountain Mahogany, *Cercocarpus ledifolius*, Western Yellow Pine in canyon and Juniper and Pinyon above on this north facing slope), 5 ♀, 1 juv. ♀.

Psychomastax psylla deserticola new subspecies (Pl. XXII, figs. 5 and 6)

This depauperate race may be distinguished by the characters given in the key and below. It agrees with typical *psylla* in the frontal costa, but is nearer *psylla robusta* in form, while exceeding even that race in the weakness of the production of the vertex and in the shortness of the eye.

The series was taken in distinctly arid environment, all in Chamisal bushes, *Adenostoma fasciculatum,* and at Cushenbury Ranch in surprisingly large numbers in the few such bushes to be found there.

Type.—♂; Cushenbury Ranch, lower slopes of San Bernardino Mountains near desert, San Bernardino County, California. Elevation 4100 feet. August 31, 1919. (Rehn and Hebard.) [Hebard Collection, Type No. 1246.]

Size very small, form compact for the species. Apterous. Fastigium in dorsal aspect projecting very slightly less cephalad than the short bulbous eyes, its lateral carinae slightly projecting and a medio-longitudinal carina traversing it and the occiput. Width of apex of fastigium slightly less than half dorsal width of eye. Fastigio-facial angle bluntly rectangulate. Eye three-quarters as broad as long, more bluntly rounded dorsad than in male of *psylla psylla.* Antennae with tooth of ninth segment obsolete.[1] Pronotum and genitalia as in *psylla psylla.*[2]

Allotype.— ♀; same data as type. [Hebard Collection.]

Agrees closely with male but larger and more robust. Fastigium broader and projecting cephalad as far as do the eyes. Width of apex of fastigium three-quarters dorsal width of eye. Eye very slightly proportionately more elongate than in male.

Male with face and proximal antennal joints yellowish buff, the antennae varying from slightly darker to russet distad. Genae sometimes turtle green. Dorsal expansion of frontal costa and postocular bars chestnut brown, the latter continued on pronotum but broken caudad and indicated only as mottling on mesonotum and metanotum. Medio-longitudinal dorsal area including vertex tawny. Lateral intervals and most of pronotal lateral lobes whitish. Sides of abdomen whitish mottled with brown. Cephalic and median limbs buffy, caudal femora more whitish with two transverse bands and apices brown.

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[1] Subobsolete but indicated in only a very few specimens of this race, rarely subobsolete or missing in individuals of the other races.

[2] See Trans. Amer. Ent. Soc., XLVI, p. 243, (1918).

Female often with face and darker markings largely turtle green, a fleck of ochraceous tawny meso-cephalad on pronotum and a medio-longitudinal band of the same running from caudal margin of pronotum to apex of abdomen. Caudal femora often suffused proximad and distad so that two pale areas appear between and after the two dark bands and dark apices.

The female of slightly atypical *psylla psylla* from Cuddy Canyon in the Ventura Mountains here recorded represents this same color phase. In the Cactus Flat series it is shown only by one female, the others being variously reddish brown and buff with similar color pattern, except two females which are much more blackish brown.

♂	Length of body	h	Length of pronotum	Length of cephalic femur	Length of caudal femur
Cushenbury Ranch, California. *Type*	9.	1.7	1.5	1.9	6.
Cushenbury Ranch, California. *Paratype*........	8.2	1.7	1.4	1.8	5.7
Cushenbury Ranch, California. *Paratype*	8.8	1.8	1.5	1.9	6.
Cactus Flat, California...	8.4	2.1	1.45	1.9	6.2
Cactus Flat, California............	8.8	1.8	1.55	2.	6.4
♀					
Cushenbury Ranch, California. *Allotype*........	11.3	1.4	1.7	1.8	6.4
Cushenbury Ranch, California. *Paratype*......................	11.3	1.3	1.75	1.8	6.5
Cushenbury Ranch, California. *Paratype*	14.	1.45	1.95	2.	6.8
Cactus Flat, California............	14.2	1.75	1.75	1.75	6.6
Cactus Flat, California......... ...	14.3	1.5	1.95	2.	7.8

Specimens Examined: 48; 13 males and 35 females.

CALIFORNIA: Cactus Flat, desert side of San Bernardino Mountains, San Bernardino County, 5900 feet, VIII, 31, 1919, (Rehn and Hebard; in Chamisal, *Adenostoma fasciculatum*), 7 ♂, 11 ♀. Cushenbury Ranch in lower valley on desert side of San Bernardino Mountains, San Bernardino County, 4100 feet, VIII, 31, 1919, (Rehn and Hebard; taken by beating, very abundant in few bushes of Chamisal present), 6 ♂, 24 ♀, *type*, *allotype*, *paratypes*.

II. CYPHODERRIS, A GENUS OF KATYDID OF SOUTHWESTERN CANADA AND THE NORTHWESTERN UNITED STATES

This remarkable genus, confined to the southwestern section of Canada and the northwestern United States, was described in 1864[3] at which time a single species, *monstrosus*, was proposed. Since then it has been reported from the northwest a number of times.

In 1904 Caudell described *piperi* as a variety[4] and in 1923[5] Buckell discussed *monstrosa* very fully, giving much information as to the individual variation occurring in material from British Columbia and questioning the validity of *piperi*. In 1924[6] Buckell recognized that two species were present in British Columbia, differing widely in the male genitalia but with females apparently indistinguishable; he considered one of these to be *monstrosus*, the other *piperi*. Study of the original description of *monstrosus* and the series now before us shows the last conclusion to be incorrect. Actually *piperi* is an absolute synonym of *monstrosa*, and the species with less highly specialized male genitalia is undescribed. To the latter we here give the name *buckelli*.

Cyphoderris buckelli new species (Pl. XXII, figs. 9, 10 and 12)

1904. *Cyphoderris monstrosa* Caudell (in part not of Uhler, 1864), Jour. N. Y. Ent. Soc., XII, p. 48. [♂; Pullman, Washington.]

1923. *Cyphoderris monstrosa* Buckell (in part not of Uhler, 1864), Canadian Ent., LV, p. 225. [British Columbian localities here recorded.]

1924. *Cyphoderris piperi* Buckell (not of Caudell, 1904), Proc. Ent. Soc. British Columbia, No. 21, p. 9. [British Columbia.]

This species was also confused with *monstrosa* by Buckell in 1921 and 1922. It differs not only in the very different male genitalia but also in averaging smaller in size. In the male the cerci are not flattened, the subgenital plate between them is bulbous instead of lamellate and cleft and that plate at its apex is not produced in a remarkable process directed ventro-cephalad.

Type.—♂; Pullman, Washington. May, 1895. (C. V. Piper.) [Hebard Collection, Type No. 1237.]

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[3] Proc. Ent. Soc. Phila., II, p. 561.

[4] Jour. N. Y. Ent. Soc., XII, p. 53.

[5] Canadian Ent., LV, p. 225.

[6] Proc. Ent. Soc. British Columbia, No. 21, p. 9.

Agrees very closely with *monstrosa* in general form and coloration, size averaging smaller. Eighth tergite (concealed by seventh dorso-laterad) produced mesad in a very strongly transverse narrow projection, the distal margin of which is straight, transverse, terminating on each side in a very small tooth. Ninth tergite completely concealed by the eighth dorso-mesad. Tenth tergite narrowly projecting in dorsal portion, there with a very deep median sulcation, which projects ventrad as a small triangle, the dorsal surface on each side of the median sulcation with a large rounded node. Paired chitinous plates between cerci produced dorsad, adjacent, the dorso-external angles of each more produced than their dorso-internal angles, conical, surmounted by a minute tooth. Cerci not flattened. Ultimate sternite with a short stout slightly incurved style dorsad on each side, between these produced in a rounded lobe with surface covered with minute short teeth.

A female, bearing the same data as the type, taken May 21, 1903, belonging to the National Museum, is here selected allotype. From the majority of the females of *monstrosa* before us this specimen differs only in its smaller size.[7] In this sex the pronotum shows no expansion or inflation caudad. Mere vestiges of tegmina and wings are visible laterad, which do not even touch each other. The ovipositor is minute, composed of four valves which taper to their blunt apices and are scarcely longer than the styles. The subgenital plate is triangularly produced but no longer than the ovipositor.

The present series, like that of *monstrosa*, is buffy brown strikingly marked with almost coppery brown and shining dark brown. In males the pronotum is usually very dark cephalad, this extending caudad on the lateral lobes and mesad and rarely flooding the mesonotum as well. The limbs are longitudinally marked with light and dark brown. The tegmina are uniform brown with veins slightly darker, occasionally paling toward the costal margins. The occiput may be solidly dark or show weakly to very prominently three to five narrow pale longitudinal lines.

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[7] Buckell wrote us in 1928 "The female of a pair which I took in coitu is the only one I have ever been able to associate definitely with one or the other of the two species."

It is probable that part of the females here recorded by us as *monstrosa* from the Chilcotin District and Nicola Lake, British Columbia, actually represent *buckelli*.

♂	Length of body	Length of pronotum	Caudal width of pronotum	Exposed length of tegmen	Length of caudal femur
Pullman, Wash. (5) .	19–22	8.5–9.5	7.9[9]–9.	7.1–7.8	9.7–9.8
Lumby, B.C. (10). . .	19–25[8]	8.1–8.7	6.8[9]–8.7	7.2–7.4	9–10.3
♀				Length of ovipositor	
Pullman, Wash	23.8	7.3	7.1	2.3	9.3

Specimens Examined: 53; 51 males, 1 female and 1 immature individual.

British Columbia: Chilcotin District, V, 26, 1920 and VII, 23, 1922, (E. R. Buckell), 1 ♂, [Canadian Nat and Hebard Clns.]. Cranbrook, V, 12, 1926, (E. R. Buckell), 1 ♂. Yahk, VI, 10, 1926, (A. A. Dennys), 1 ♂, *paratype*. Lumby, V, 3, 1925 and V, 13, 1927, (E. R. Buckell), 10 ♂, *paratypes*. Kelowna, V, 18, 1921, (R. C. Treherne), 1 ♂, *paratype*. Okanagan Falls, V, 6, 1913, (E. M. Anderson), 1 ♂, *paratype*, [U. S. N. M.]. Rock Creek, VI, 9, 1923, (E. R. Buckell), 1 ♂, *paratype*, [U. S. N. M.]. Nicola Lake, V, 20 and 21, 1922, (E. R. Buckell), 14 ♂, *paratypes*, [Canadian Nat, U. S. N. M. and Hebard Cln.]. Aspen Grove, V, 26 to VI, 15, 1922, (P. N. Vroom), 4 ♂, *paratypes*, [U. S. N. M.].

Washington: Pullman, IV, 5, 1902, (C. V. Piper), 1 juv. ♂, [U. S. N. M.]; (J. L. Webb), 1 ♂, *paratype;* V, 10 to 30, 1895 to 1903, (C. V. Piper), 8 ♂, 1 ♀, *type*, *allotype* and *paratypes*, [U. S. N. M. and Hebard Cln.].

Idaho: Moscow, VII, 28, 1910, (J. M. Aldrich), 1 ♂, *paratype*, [U. S. N. M.]; near base of Moscow Mountain, 3000 feet, VI, 11, 1933, (P. L. Rice; singing at night on shrubs in sparsely timbered area), 7 ♂, *paratypes*, [Hebard Collection].

Cyphoderris monstrosa Uhler (Pl. XXII, figs. 7, 8 and 11)

1864. *C[yphoderris] monstrosus* Uhler, Proc. Ent. Soc. Phila., II, p. 551. [♂, Oregon.]

1904. *Cyphoderris monstrosa* var. *piperi* Caudell, Jour. N. Y. Ent. Soc., XII, p. 53, [♂, ♀; Paradise Valley at 6000 feet, Mount Rainier, Washington].

1924. *Cyphoderris monstrosa* Buckell, Proc. Ent. Soc. British Columbia, No. 21, p. 9. [British Columbia.]

The male genitalia are fortunately sufficiently discussed in Uhler's diagnosis to enable us to recognize *monstrosa* beyond query. In Caudell's 1904 treatment of the genus his figure 1 is poorly drawn and represents a male in the instar preceding maturity, not a female as was indicated. Comparison of the original series of *piperi* with our other series shows that recognition of a race is not warranted, as was suggested by Buckell in 1923. Caudell gave only the larger size, more definite dorso-lateral pronotal sulcation, greater pronotal inflation caudad and more extensive dark marking of the pronotum to separate his variety *piperi* from typical *monstrosa* and it is now clear that all these features must be attributed to individual variation. The pronotal coloration is particularly variable and the dark portion includes only the meso-dorsal portion of the lateral lobes (many females and all immatures, sometimes weak in the latter), or spreads to form a transverse band cephalad (many males, few females) or includes all the pronotum except its ventral margin or the cephalic portion of that margin (very few males).

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[8] Abdomen extruded.

[9] Pronotum, as is occasionally the case in most series, very much less inflated caudad than is normal.

Compared with the male genitalia under *piperi*, those of *monstrosa* are further shown in the accompanying figures.

The distribution of *monstrosa* is now known to extend north to the Saskatchewan River below the junction of the North Fork, Saskatchewan (Rehn, 1908); Banff, Alberta, and Field to the head of Moose River and the Chilcotin District of British Columbia: east to the first locality here given; Thompson Falls, Montana; Wind River, Wyoming, and Pearl in extreme northern central Colorado: south to the latter; Centerville, Idaho, and the upper Rogue River in southwestern Oregon.

In addition to a number of specimens before us which have been previously correctly recorded, we here record 105 specimens; 56 males, 36 females and 13 immature individuals.

ALBERTA: Banff, VI, 10 to VIII, 8, 1902 to 1927, (Sanson; Bryant), 2 ♂, 1 ♀, 1 large juv. ♀, 1 juv. ♀, [Canadian Nat. and U. S. N. M.]. Lake Louise, VIII, 20, 1927, (L. A. Stephenson), 1 juv. ♀, [Hebard Cln.].

COLORADO: Vicinity of Pearl, North Park, 8800 feet, VIII, 17, 1932, (G. Alexander), 1 ♂, [Hebard Cln.].

IDAHO: Kellog, VI, 25, 1926, (R. E. Hutchins), 1 ♂, [Hebard Cln.]. Coeur d'Alene Lake, 1 juv. ♀, [Hebard Cln.]. Centerville, 5000 feet, (Webb), 1 ♀, [U. S. N. M.].

BRITISH COLUMBIA: Field, VII, 15, 1927, (T. Ulke), 1 ♂, [U. S. N. M.]. Head of Moose River, VII, 17, 1911, (N. Hollister), 1 ♂, 1 juv., [U. S. N. M.]. Vavenby, VI, 1, 1924, (T. A. Moilliet), 1 ♂, [U. S. N. M.]. Salmon Arm, VI, 10, 1924, (E. R. Buckell), 10 ♂, 2 ♀. Lumby, V, 3, 1925, (E. R. Buckell), 3 ♂, 1 ♀, (pair taken in coitu), [Hebard Cln.]. Peachland, VII, 1907, 1 ♂, [Canadian Nat. Cln.]. Nicola Lake, V, 20 to VIII, 20, 1922, (E. R. Buckell), 15 ♂, 12 ♀, [Canadian Nat., U. S. N. M., Univ. of Idaho and Hebard Clns.]. Lilloet, VII, 2, 1920, (A. B. Baird), 3 ♂, [Canadian Nat. and Hebard Cln.].

Chilcotin District, IV, 11, 1923, 1 juv. ♂; V, 24 to VII, 14, 1920 to 1922, (E. R. Buckell), 10 ♂, 16 ♀, 1 juv. ♀, [Canadian Nat., Acad. Nat. Sci. Phila., and Hebard Clns.]. Gold River, 7000 feet, VII, 29, 1926, (Heacock; nocturnal), 1 ♂, [Acad. Nat. Sci. Phila.].

WASHINGTON: Stampede, 2800 feet, VIII, 5 and 6, 1909, (Rehn and Hebard; on steep slopes under stones and in fir forest), 2 ♂, 2 ♀, 4 juvs [Hebard Cln. and Acad. Nat. Sci. Phila]. Yakima, 1 ♂, [Hebard Cln.]. Klikitat Valley, VII, 10, 1882, (S. Henshaw), 1 large juv. ♂, [Mus. Comp. Zool]. Paradise Valley, Mt. Rainier, 5850 feet, VII, 9, 1911, (J. R. Slevin), 1 ♀; VII, (A. N. Caudell), 1 ♂, [U. S. N. M.]; VII, 19 to 29, 1905, (M. W. Lyon Jr.), 1 large juv. ♂, 2 large juv. ♀; VIII, 25, 1905, (H. G. Barber; singing in fir trees just below timber line after dark), 2 ♂, [U. S. N. M.]

At Stampede, Washington, a male was found under a stone while clearing a camp site in the fir forest during the afternoon. It was sound asleep, would not jump and when laid on its back remained in that position. Other specimens were also found under stones the following day. When disturbed they would often give a clumsy jump, alight on their backs or sides and with legs tucked up closely would remain motionless. When in such position the pinkish white undersurfaces of body and limbs perfectly resembled the pallid growing shoots of plants under the stones which had been overturned.

Immediately after sunset the males began to sing, a faint elusive note repeated much like that of *Scudderia* but far less harsh and of a decidedly higher pitch, in timbre suggesting that of *Oecanthus*. This song continued only until the evening chill (decided in this environment) commenced. So ventriloquistic was the song and so numerous the singers that individuals were exceedingly difficult to locate and but one specimen was taken at that time, stridulating on the ground and becoming silent when approached, but not moving except to draw up its legs closely and roll over. The telegraph operator at Stampede said that these insects often come indoors at night and hop about rather actively.

EXPLANATION OF PLATE XXII

Fig. 1.—*Psychomastax psylla psylla* Rehn and Hebard. Male, *type*. Strawberry Valley, San Jacinto Mountains, California. Dorsal outline of head. (Greatly enlarged.)

Fig. 2.—*Psychomastax psylla psylla* Rehn and Hebard. Female, *allotype*. Strawberry Valley, San Jacinto Mountains, California. Dorsal outline of head. (Same scale.)

Fig. 3.—*Psychomastax psylla robusta* new subspecies. Male, *paratype*. Lee Canyon, Spring Mountain Range, Nevada, at 8000 to 8500 feet. Dorsal outline of head. (Same scale.)

Fig. 4.—*Psychomastax psylla robusta* new subspecies. Female, *paratype*. Lee Canyon, Spring Mountain Range, Nevada, at 8600 feet. Dorsal outline of head. (Same scale.)

Fig. 5.—*Psychomastax psylla deserticola* new subspecies. Male, *type*. Cushenbury Ranch, at 4100 feet, San Bernardino County, California. Dorsal outline of head. (Same scale.)

Fig. 6.—*Psychomastax psylla deserticola* new subspecies. Female, *allotype*. Cushenbury Ranch at 4100 feet, San Bernardino County, California. Dorsal outline of head. (Same scale.)

Fig. 7.—*Cyphoderris monstrosa* Uhler. Male. Cloud Cap Inn, Mount Hood, Oregon. Lateral view of distal portion of male abdomen. (Greatly enlarged.)

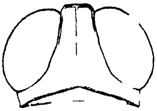
Fig. 8.—*Cyphoderris monstrosa* Uhler. Male. Cloud Cap Inn, Mount Hood, Oregon. Ventral view of distal portion of male abdomen. (Same scale.)

Fig. 9.—*Cyphoderris buckelli* new species. Male, *type*. Pullman, Washington. Lateral view of distal portion of male abdomen. (Same scale.)

Fig. 10.—*Cyphoderris buckelli* new species. Male, *type*. Pullman, Washington. Ventral view of distal portion of male abdomen. (Same scale.)

Fig. 11.—*Cyphoderris monstrosa* Uhler. Male. Cloud Cap Inn, Mount Hood, Washington. Lateral view of entire insect. (× 1)

Fig. 12.—*Cyphoderris buckelli* new species. Male, *type*. Pullman, Washington. Lateral view of entire insect. (Same scale.)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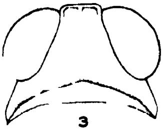
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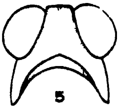
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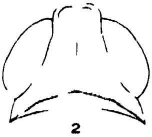
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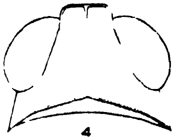
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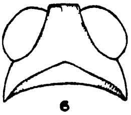
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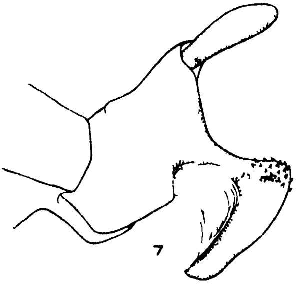
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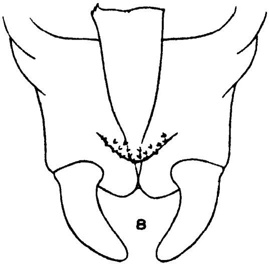
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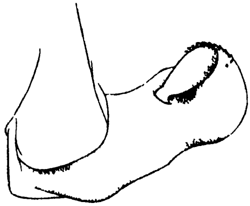
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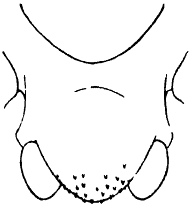
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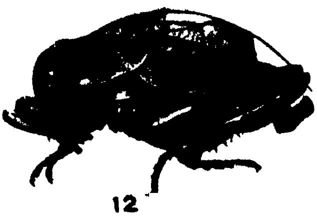
12

HEBARD—NORTH AMERICAN ORTHOPTERA

TWO MEXICAN SPECIES OF PALAEMNEMA

(ODONATA: AGRIONIDAE)

BY PHILIP P. CALVERT
University of Pennsylvania, Philadelphia

The Museum of Zoology, University of Michigan, through Mrs. Leonora K. Gloyd, has sent me some Mexican specimens of the genus *Palaemnema* for identification. They are to be referred to two species, *P. paulitoyaca* Calvert and *P. paulicoba* Calvert, described from very scanty material in these Transactions, volume LVII. It therefore seems appropriate to record in this place the additional information which they yield. The new locality for *P. paulitoyaca* is two degrees of latitude farther north than any hitherto recorded for this genus.

Palaemnema paulitoyaca Calvert

1931. *Palaemnema paulitoyaca* Calvert, Trans Am. Ent. Soc., LVII, pp. 25, 47, pl. 5, figs. 49 A–G″ (apps. ♂, penis), pl. 18, figs. 74–76 (thoracic pattern). (Misantla and Atoyac, Vera Cruz)

Additional material examined. MEXICO: 15 miles south of Valles, San Luis Potosi, June 13, 1932. H. M. Smith and E. H. Taylor. Museum of Zoology, University of Michigan, 1 ♂, 1 ♀.

♂. Differs from the description above cited as follows: No mid-dorsal black line on the fore prothoracic lobe. Propleuron black, narrowly pale (blue?) inferiorly.

Blue antehumeral stripe .41 mm. wide at mid-height, at which level the black humeral stripe is about one-third as wide; maximum width of the blue antehumeral .5 mm. at a little above its lower end. The black humeral is abruptly widened posteriorly on the lower end of the mesepimeron. The region of the first lateral (interpleural) suture is discolored and unlike on the two sides of this male. Black stripe on the second lateral (metapleural) suture .5 mm. wide at mid-height. A narrow black stripe on the metepimeron above the latero-ventral carina, which, except for the interruption due to the pale carina itself, is continued on to the metasternum as a wider stripe. The thoracic pattern is on the whole very similar to that of the type male from Atoyac shown in figs. 74 and 76 above cited.

Apical fifth (6 mm.) of the wings dark brown, but with many of the cross-veins margined with hyaline. Postnodals: front wings 24 (right), 25 (left); hind wings 22 (r), 23 (l).

Superior appendages and penis as described and figured, but the apex of the inferiors is more like that shown in pl. iv, figs. 47F and G for *paulina* Drury than as shown in pl. v, figs. 49F and G for *paulitoyaca* Calv.

♀. As described for the male, *loc. cit.*, p. 47, except as follows: nasus dark brown, a rounded blue spot at each extremity, right and left, propleuron pale inferiorly.

Pale yellow antehumeral stripe .25 mm. wide at mid-height, its maximum width .33 mm., a little above its lower end. Brown humeral stripe .16 mm. wide at mid-height. Mesepimeron brown, if not discolored. A brown stripe on the metapleural suture, .33 mm. wide at mid-height. A brown metepimeral stripe dorsal to the latero-ventral carina and a continuation thereof on the metasternum; these are narrower and paler than in the male described above.

Abdominal segment nine black, a round blue spot each side, almost as long as the segment but not reaching either base or apex, confluent mid-dorsally with its fellow of the opposite side for nearly the anterior half of the segment.

Extreme apex of wings faintly brownish. Postnodals, front wings 24 (r), 23 (l); hind wings 19 (r), 21 (l).

Dimensions. Abdomen: ♂ 41, ♀ 34. Hind wing: ♂ 31, ♀ 27. Pterostigma: front wing, costal margin, ♂ 1.39, ♀ 1.31; hind margin, ♂ 1.55, ♀ 1.55. Maximum width of front wing: ♂ 6.30, ♀ 5.72; of hind wing, ♂ 6.22, ♀ 5.48 mm.

Habitat. Mrs. Gloyd has kindly procured the following information from Mr. H. M. Smith, one of the collectors: "The specimens from south of Valles were collected along a small stream in the foothills of the plateau. The stream is, as I remember, about 5 miles south of the town. The general region is heavily overgrown with masses of vegetation, mostly of low shrubs, vines, etc., so that in many places along the stream it was difficult to follow along the banks." According to the map of Mexico in the Century Atlas (1906) and the mineral and agricultural maps of that country prepared by M. Hendges in the Bureau of American Republics (1900), Valles is situated at 22° North Latitude and 99° West Longitude, on a branch (Rio Tampaon) of the Rio S. Maria, which later becomes the Rio Tamuin, a left tributary of the Rio Panuco. Hendges' agricultural map places Valles in the lower part of altitude zone 500–1000 meters. Henry Gannett's "List of Altitudes in Mexico, etc.," (Bull. Internat. Bur. Amer. Repubs., Sept., 1904) gives the elevation of Valles as 311 feet.

Comparisons. In spite of the difference in the shape of the apex of the inferior appendages of this male in comparison with the typical specimens, it agrees on the whole better with *P. paulitoyaca* than with any other species. It has been compared with the types, paratypes or other specimens of related species before the material used in the monograph of 1931 was returned to its owners. The female falls under rubric UUU of the key on page 29 of that monograph, along with *P. angelina.* A direct comparison with the four females referred to *angelina,* page 58, has yielded only this constant difference: the latter have the transverse occipital carina more pronounced and its extremities distinctly angulate, while the female from south of Valles, here referred to *paulitoyaca,* has it less developed, its extremities only subangulate. The difference in this carina of the males of *angelina* and *paulitoyaca* is not as great.

Palaemnema paulicoba Calvert

1931. *Palaemnema paulicoba* Calvert, Trans. Am. Ent. Soc., LVII, pp. 25, 45, pl. 5, figs. 48 A–G (apps. ♂, penis). (Las Tortolas, near Cordoba, Mexico)

Additional material examined. MEXICO: Tierra Colorada, near Vera Cruz, Vera Cruz, July 15, 1932, H. M. Smith and E. H. Taylor. Museum of Zoology, University of Michigan, 3 ♂, 1 ♀.

♂. Differs from the above cited description as follows: Lateral extremities of the transverse occipital carina angulate or subangulate. In one male the three bluish spots on the nasus are confluent to form a transverse blue stripe. Propleuron pale inferiorly.

Blue antehumeral stripe not as abruptly narrowed as in the type, its upper three-eighths of nearly uniform width. Maximum width of the black humeral stripe, at the lower end of the mesepimeron, .57–.65 mm. A small blue spot on the mesinfraepisternum near the supero-anterior angle, also its postero-inferior angle blue.

Postnodals: front wings, 20–23 (20 most frequently); hind wings, 18–22. Nodal sector arising: front wings, at the eighth to beyond the ninth postnodal (at the ninth most frequently); hind wings, at the sixth or seventh postnodal (at the seventh most frequently). Ultranodal sector arising: front wings, at the tenth to twelfth postnodal; hind wings, at the eighth to eleventh; or in cells behind the median vein, proximad to the stigma, front wings 8–9, hind wings 8–10. Upper sector of the triangle ending distad to the level of origin of the ultranodal by 3–4 cells in the area behind the ultranodal (4–6 marginal cells), front wings; or by 4–5 cells (6–9 marginal cells), hind wings. Stigma surmounting 2 + to 3 + cells, front wings; 2 + to 3 cells, hind wings. Brace vein to the stigma in five out of six front wings, in all six hind wings.

♀. Differs from the description of the male type as follows: The three blue spots on the nasus confluent to form a transverse blue stripe for almost the whole width of the sclerite.

Blue antehumeral stripe and mesinfraepisternum as described above for the three males from the same locality. Maximum width of the black humeral stripe .65 mm., at the lower end of the mesepimeron.

Tergites of abdominal segments eight and nine chiefly blue, eight with a dorsal black spot in its anterior four-fifths, nine with a fine transverse line at base and at apex connecting with a longitudinal inferior black stripe which extends for the entire length of the segment on each side.

Apical 3 mm. of each wing brown, beginning under the stigma. Postnodals: front wings, 19; hind wings, 17. Ultranodal sector arising in cells behind the median vein, proximad to the stigma, front wings, 7 (r), 8 (l). Stigma surmounting 2 cells (all wings). Other venational details as given above for the males.

Dimensions. Abdomen: ♂ 34; ♀ 30. Hind wing: ♂ 23.5–24.5; ♀ 23. Stigma: front wing, costal margin, ♂ 1.06; ♀ .98; hind margin, ♂ 1.31–1.47. Maximum width of front wing: ♂ 5.32; ♀ 4.82; of hind wing: ♂ 5.24; ♀ 4.58 mm.

Habitat. Mr. H. M. Smith has sent the following note on the place where these specimens were taken to Mrs. Gloyd: "The locality Tierra Colorada, Vera Cruz, is a small town or village 25–30 kilometers almost directly west of the city Vera Cruz. It is marked on a certain road map we secured in Mexico City. I can't recall the exact circumstances under which I collected the particular specimens you describe, but the general nature of the locality might be illuminating. The place is on the coastal plains, 30–40 kilometers from the central high plateau. The general level is thus rather low, and at the time we were there (the rainy season) there was much water about—in the road, and in low fields or pastures. Most of the Odonata were collected in these temporary pools, or near them. Vegetation in this region was moderately heavy, but in no place too thick to penetrate with moderate ease."

Comparisons. These males from Tierra Colorada present no essential difference from the type male. The female of *P. paulicoba* has not been described previously. By our key of 1931, pages 28–29, the present individual would fall under the rubric S, except that abdominal segment eight has the sides and the apex of the dorsum blue. In the absence of metepimeral and metasternal dark markings, it resembles females of *P. distadens* from Costa Rica (rubric UU), but has the blue antehumeral stripe wider, the dark humeral stripe narrower.

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New names are followed by the name of the author within parentheses ( ). An asterisk (*) denotes that a figure is cited. Names and page numbers in italics refer to synonyms.

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